NONRESIDENT
TRAINING
COURSE

Air Traffic Controller

NAVEDTRA 14342

PREFACE

About this course:

This is a self-study course. By studying this course, you can improve your professional/military knowledge, as well as prepare for the Navywide advancement-in-rate examination. It contains subject matter about day-to-day occupational knowledge and skill requirements and includes text, tables, and illustrations to help you understand the information. An additional important feature of this course is its reference to useful information in other publications. The well-prepared Sailor will take the time to look up the additional information.

History of the course:

- *Sep 1998: Original edition released.*
- *Aug 2003: Administrative update released. Technical content was not reviewed or revised.*

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CHAPTER 1

AVIATION WEATHER

Overview

Introduction

Weather phenomenon, as it affects aviation, is an integral part of your job as an Air Traffic Controller (AC). You will be part of a team to keep pilots informed of current, and forecasted weather conditions that will effect the safety of flight and sometimes the pilots' very survival.

As an AC, you must accurately report weather conditions and recognize any differences between the actual weather conditions, as observed from the tower, and those indicated by the current report. You must understand how current and developing meteorological conditions affect just about every decision you and the pilot make, from the preflight planning stage to landing rollout. It is critical that you understand the information in this chapter and realize the impact weather has on the safe, expeditious flow of air traffic.

Objectives

The material in this chapter will enable you to:

- Identify standard (sea level) pressure and associated atmospheric terms, their characteristics, and effects.
- Identify the major cloud formations and types, their general characteristics, and the levels at which they occur.
- Identify the types, effects, designations, and characteristics of fronts.
- State possible controller operational considerations for certain weather conditions.
- Identify the activities that provide weather service to pilots, and the methods used to distribute weather information.
- Decode weather data using standard codes and contractions.
- State the proper broadcasting procedures and phraseology used to transmit weather information to pilots.
- Obtain weather information from pilots and relay it to aircraft and area air traffic control facilities.
- Identify and explain the different types of forecasts, advisories, and warnings issued by the Navy and the National Weather Service (NWS).

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Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
AC	Air Traffic Controller
AG	Aerographer's Mate
AGL	Above ground level
AIRMET (WA)	Airmen's meteorological information
ASOS	Automated surface observation system
AWOS	Automated weather observation system
FAA	Federal Aviation Administration
FIDO	Flight data input/output
METAR	Aviation Routine Weather Reports
MSL	Mean sea level
nm	Nautical mile
NWS	National weather service
PIREP	Pilot weather report
RCR	Runway condition reading
RSC	Runway surface condition
SIGMET (WS)	Significant meteorological information
SPECI	Aviation Selected Special Weather Reports
TAF	Terminal area forecast
UTC	Coordinated Universal Time
WST	Convective SIGMET

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Topics

This chapter is divided into six sections:

Section A
Atmosphere

Overview

Introduction

All of the weather that we experience occurs in the atmosphere, which is a thin blanket of gases that surrounds the earth. The radiant energy of the sun is the catalyst that causes the different weather and wind patterns that we experience. In this section we will discuss some of the basic characteristics of our atmosphere.

In this section

This section covers the following topics:

Earth's Atmosphere

Background

The atmosphere is a thin blanket of gases, mostly nitrogen and oxygen, that surrounds the earth and is held in place by the earth's gravity. All of the weather that we experience occurs within 7 miles of the earth's surface. The radiant energy of the sun causes the different weather and wind patterns that we experience. In this section, we will discuss some of the basic characteristics of our atmosphere.

Layers of the atmosphere

The earth's atmosphere extends upward many hundreds of miles and is divided into five basic layers with narrow boundaries between the bottom four layers.

Layer or Boundary	Remarks
Troposphere	Extends upwards from the earth's surface approximately 7 miles. All weather occurs in this layer.
Tropopause	Boundary separating the troposphere and the stratosphere. Height varies, normally found at higher elevations near equatorial regions and decreases in height towards the North and South Pole. Jet stream occurs in the tropopause.
Stratosphere	Extends upwards to approximately 30 miles. Temperature increases with height. Ozone concentration is heaviest in this layer.

Additional boundaries and layers above the stratosphere include the stratopause, mesophere, thermosphere, and ectosphere.

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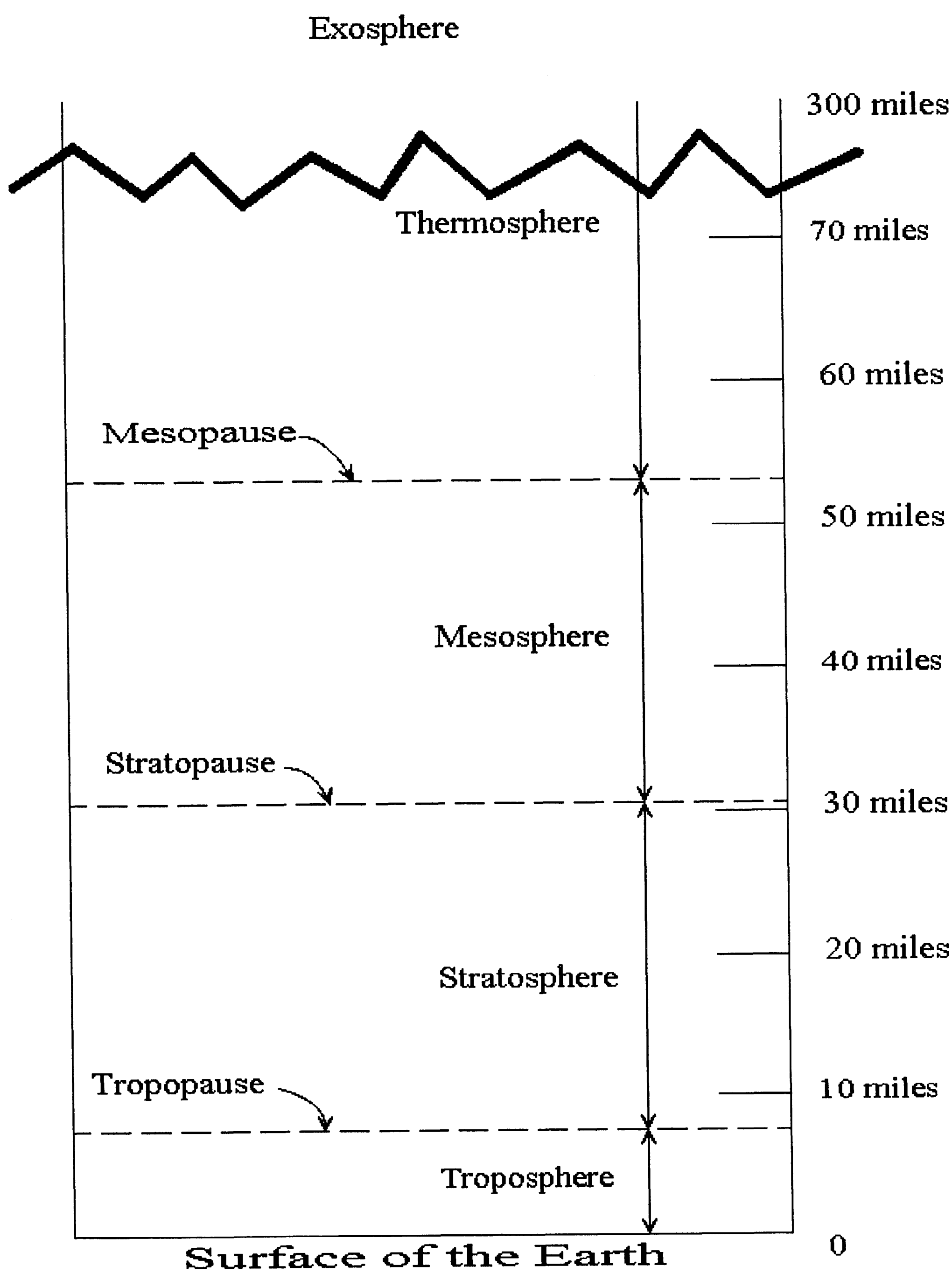
Diagram

A vertical cross section of the earth's atmosphere is depicted below.



Atmospheric Pressure and Temperature

Background

The atmosphere is made up of molecules that we call air. These air molecules have weight (approximately 1.2 ounces per cubic foot at sea level), and the amount of weight these air molecules exert on the earth's surface is called atmospheric pressure. You must understand how an aircraft uses atmospheric pressure to determine altitude and how pressure and temperature changes have an affect on the aircraft's instruments.

Units of measurement

There are two basic units used to measure and report the atmospheric pressure, inches and millibars.

Atmospheric pressure is measured using either a mercury or aneroid barometer. Air pressure pressing against a mercury barometer causes mercury to rise in an evacuated glass tube. Air pressure at sea level causes the mercury to rise in the glass tube, on the average, 29.92 inches (standard sea-level pressure). Mercury is used because it is such a dense, heavy liquid, the same pressure would cause water to rise approximately 400 inches in the same tube. An aneroid barometer uses a thin metal strip in an evacuated case to measure pressure.

In the United States, we report the barometric pressure in inches (for example, 29.92 inches) and this is the unit of measurement that you will be most concerned with. However, a pilot will occasionally ask for the altimeter in millibars which is the scientific unit of measurement. Normally you will have to contact the weather reporting service for your station to obtain this reading. The table below gives a comparison of inches to millibars:

Inches	Millibars	Inches	Millibars
26.58	900	28.94	980
26.87	910	29.24	990
27.17	920	29.53	1000
27.46	930	29.82	1010
27.76	940	29.92	1013.25
28.05	950	30.12	1020
28.35	960	30.42	1030
28.64	970	30.71	1040

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Altimeters

Atmospheric pressure is used to indicate the altitude of an aircraft. A barometer (aneroid type) carried on board an aircraft is called an *altimeter.* The altimeter has a scale to indicate altitude instead of pressure. As an aircraft increases altitude there is less air above the aircraft therefore less pressure on the altimeter. An aircraft uses surface pressure as a reference point, so the pilot must change altimeter setting as he flies along a route of flight below 18,000 feet (above 18,000 feet all aircraft set their altimeters at 29.92). It is critical to flying safety that an aircraft have the correct altimeter setting for the area it is operating in.

Effects of changes in atmospheric pressure

An aircraft must have the correct altimeter setting for the area in which it is operating since this is what altitude and vertical separation are based on. Without having the correct altimeter setting the indicated altitude of the aircraft will not be correct.

For example, when an aircraft flies from a high-pressure area into a low-pressure area and the altimeter setting is not corrected, the altimeter will read too high. Going from a low-pressure area to a high-pressure area, the altimeter will read too low. A simple rule to help you remember this is:

Flying From	Altimeter Reads
High to low pressure	Too high
Low to high pressure	Too low

Effects of changes in temperature

The same rule applies to temperature changes. The altimeter of a plane flying from a low-temperature area into a high temperature area will read too low; and from a higher temperature area to a lower temperature area, too high.

Temperature	Altimeter Reads
High to low temperature	Too high
Low to high temperature	Too low

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Errors in altimeter

The approximate amount of error in the altimeter reading that is due to incorrect altimeter setting can be determined for the lower levels of the atmosphere by applying the corrections in the following table:

Pressure Change	Altimeter Error
1 inch of mercury	1,000 feet
1/10 inch of mercury	100 feet
1/100 inch of mercury	10 feet

Pressure Systems

Introduction

Pressure systems are either high-pressure (anticyclonic) areas or low-pressure (cyclonic) areas. A basic understanding of pressure systems, their distinguishing characteristics, and the weather phenomena associated with them is necessary to understand concepts that will be presented later in this chapter.

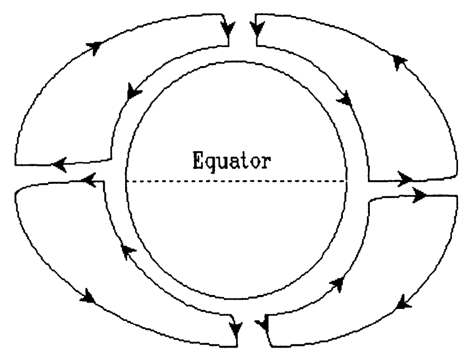
Formation and movement

One of the reasons that high and low-pressure areas form is the uneven heating of the earth's surface. Areas near the equator receive more heat which causes the air to expand and rise which produces an area of low pressure.

The atmosphere tends to maintain equal pressure over the entire earth. When this equilibrium is upset (for example, by the formation of a high- pressure area), air flows from areas of high pressure to areas of low pressure attempting to maintain equal pressure. The heavier denser air from the north and south poles moves along the earth's surface towards the equator while the lighter warmer air moves towards the poles.

As this air moves, it doesn't travel in a straight line from equator to pole, because it is affected by:

- The earth's rotation
- Uneven heating over water and land
- Seasonal and daily temperature changes



The earth's rotation causes the air to flow to the right of its normal path in the northern hemisphere and to the left in the southern hemisphere. This explains why, in the northern hemisphere, weather patterns and high- and low-pressure systems generally move from west to east.

Cyclones (low-pressure systems)

In a low-pressure system, barometric pressure decreases toward the center. The wind flow around the system is counterclockwise in the northern hemisphere. A low-pressure system is generally associated with unfavorable flying conditions because of low clouds, restricted visibility, and strong gusty winds. Hurricanes, Typhoons, and Tropical Storms are examples of severe low-pressure systems.

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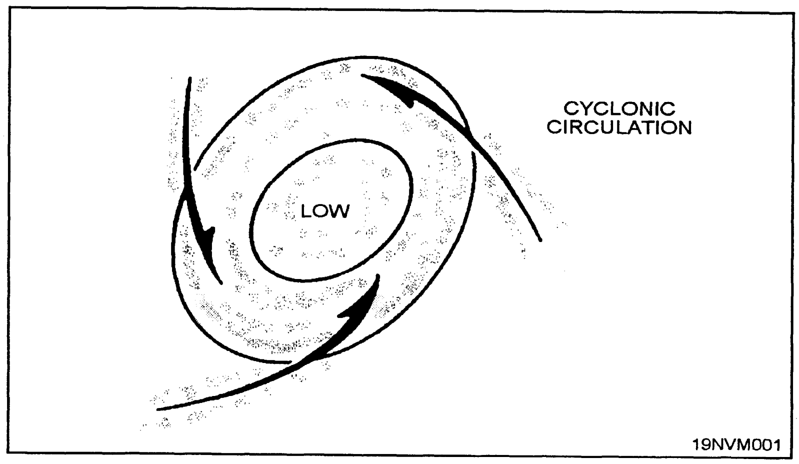
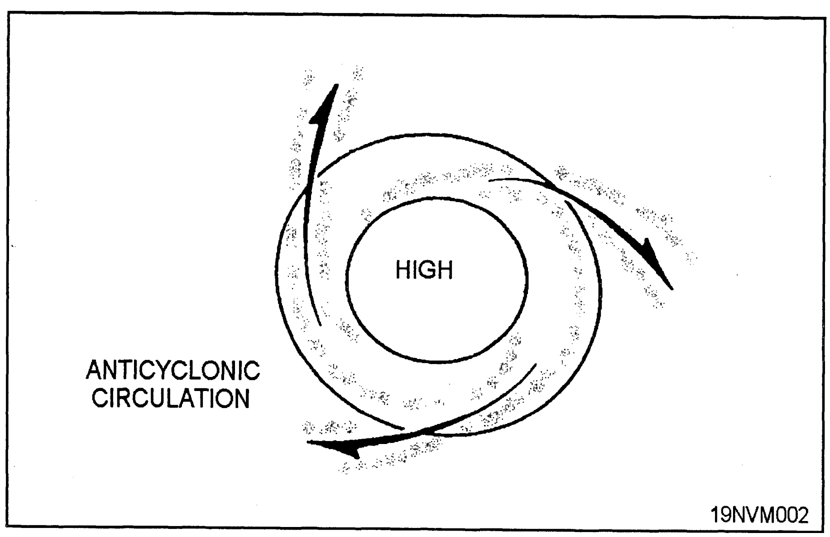
Anticyclones (high-pressure systems)

In the northern hemisphere, the wind flow around a high-pressure area is clockwise. Flying conditions are generally more favorable in high-pressure systems because there are fewer clouds, better visibility, less wind, and fewer areas of concentrated turbulence. The diagrams below depict wind flow around low- and high-pressure areas.





Section B
Clouds and Their Characteristics

Overview

Introduction

Clouds have been called signposts in the sky. They are an indication of what the atmosphere is doing. Understanding cloud types will help you to predict weather conditions, recognize potential weather hazards, and assist the pilot in the safe handling of his or her flight.

In this section

This section covers the following topics:

Clouds Composition and Formations

Introduction

Clouds are composed of small liquid water droplets and/or ice crystals.

Cloud composition

Clouds form when the temperature of the surrounding air is between 5°F and 32°F and are composed mostly of supercooled water droplets with small amounts of ice crystals. Below 5°F, clouds are composed almost entirely of ice crystals.

Cloud particles (droplets) are extremely small, about one-thousandth of an inch in diameter, and as they become more dense, or clustered together, they become visible as clouds. The average raindrop contains about one million times the water in a cloud droplet.

Cloud formations

Clouds are arranged in three families, low (surface to 6500 feet), middle (6500 feet to 16,500 feet) and high (16,500 feet to 45,000 feet) and are categorized into 10 basic types that have many different forms and varieties. Two additional types of cloud formations are cumulonimbus mamma and lenticular.

Cloud Types and Characteristics

Introduction

There are many different types of clouds with their own distinguishing characteristics.

Cloud types

The table below lists some of the more common types of clouds, their characteristics, and some of the hazards associated with each.

Type	Characteristics	Hazards to Aviation
Cirrus	Fibrous and delicate in appearance. Clouds look like white wisps against the sky. First sign of approaching bad weather. When these clouds become more compact and merge into cirrostratus, an approaching warm front may be indicated.	Flying conditions are good. Negligible turbulence. Pure ice crystal composition of these clouds precludes surface icing on the aircraft.
Cirrocumulus	Appear like fleecy flakes or small white cotton balls. Like the scales on a fish—often called a *mackerel* sky.	Light to moderate turbulence. No icing on aircraft surfaces.
Cirrostratus	Smooth, thin-layered cloud covering all or most of the sky, giving the sky a milky appearance. Produces halo around sun or moon. When these clouds lower, thicken, and merge into altostratus, the approach of a warm front and bad weather is imminent.	Icing and turbulence usually present; no hazard to flying.
Altocumulus	Sometimes appear like cirrocumulus, but the balls or flakes are thicker and grayer. Appear similar to a herd of sheep in the sky. The underside of each cloud is dark because of the thickness.	Poor visibility within these clouds. Light to moderate turbulence and icing. The icing is usually the clear type.
Altostratus	Appear as a thick gray or blue-gray smooth overcast. Thicker and less transparent than cirrostratus clouds. Precipitation in the form of light rain or snow.	Light to moderate icing (predominantly rime ice). Light turbulence. Visibility within these clouds is 50 to 200 yards.

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Clouds Types and Characteristics, Continued

Type	Characteristics	Hazards to Aviation
Nimbostratus	Thick, dark gray clouds that are formless in appearance. Precipitation is always falling from these clouds (may not always reach the surface).	Moderate to heavy turbulence and icing with very poor visibility within and below the cloud.
Stratocumulus	Occur as an extensive and fairly level layer marked by thick rolls and dark, rounded masses underneath. Precipitation infrequent; when occurs, it is in the form of very light rain showers or snow flurries.	Poor visibility within these clouds. Light to moderate turbulence. Moderate icing conditions. May form clear or rime ice.
Stratus	Flat, shapeless, dull gray, uniform layer of cloud. Precipitation in the form of drizzle only.	Only light turbulence and moderate icing may be present. Visibility is very poor when drizzle occurring.
Cumulus	Dense clouds with vertical development. The cloud's upper surfaces are dome shaped and exhibit rounded protuberances, while their bases are nearly horizonal.	Strong updrafts occur within and under these clouds. Turbulence and icing of varying intensities are common depending on the extent of vertical development.
Cumulonimbus	Cumulus clouds with great vertical development that resembles mountains or towers. Tops may extend higher than 60,000 feet and resemble an anvil. Precipitation is violent, intermittent showers.	Extreme turbulence and severe icing. Severe up and down drafts.. Microbursts and low-level wind shear occur under this type of cloud. Damaging hail is possible.
Cumulonimbus Mamma	Large, baggish clouds with protuberances, like udders or pouches, on the undersurface.	This type of cloud indicates extreme turbulence. Conditions ideal for tornado development.
Lenticular	Clouds have the shape of lenses or almonds. Normally formed by wind flow in mountainous areas.	Usually associated with extreme turbulence.

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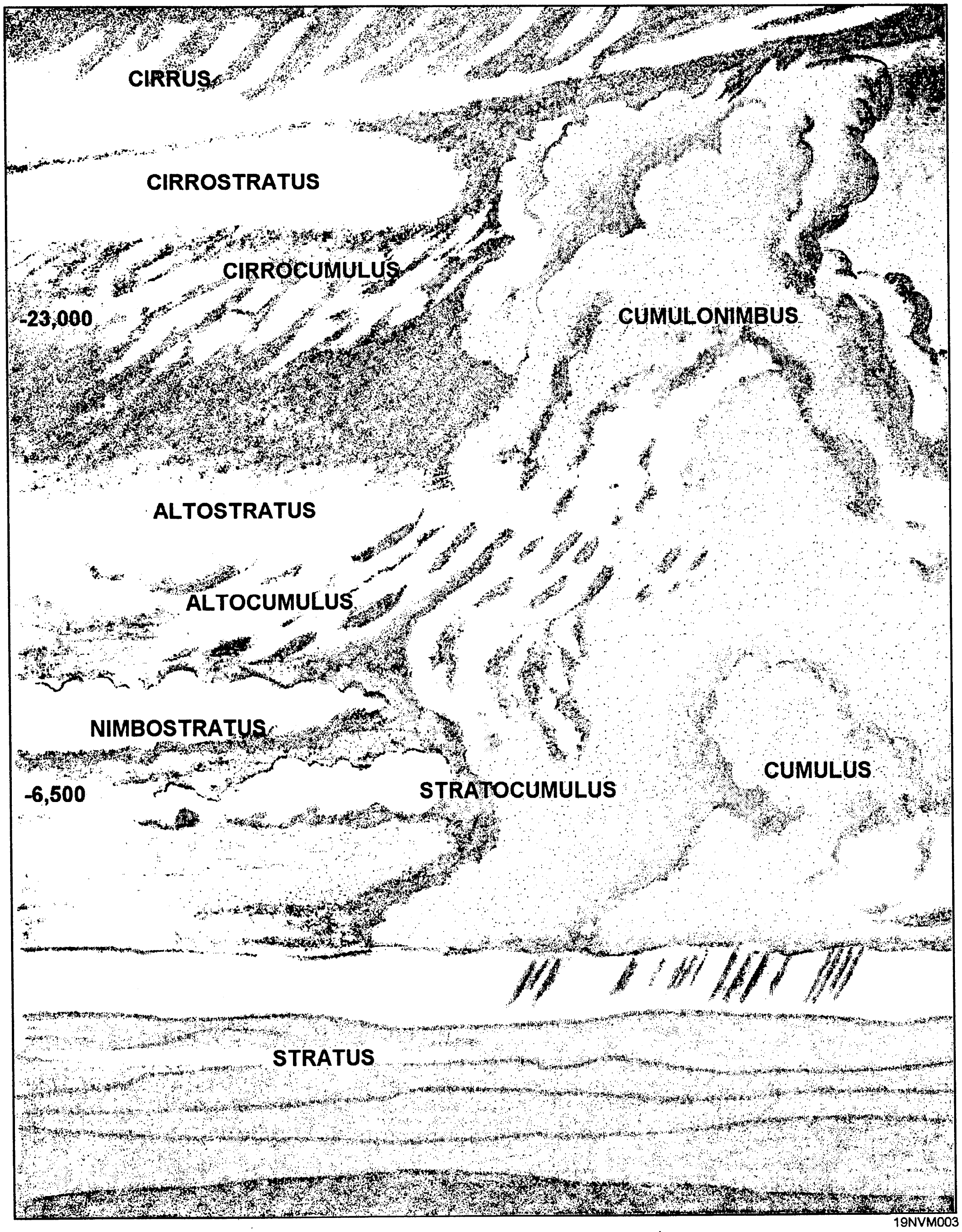
CIRRUS
CIRROSTRATUS
CIRROCUMULUS
-23,000
CUMULONIMBUS
ALTOSTRATUS
ALTOCUMULUS
NIMBOSTRATUS
-6,500
STRATOCUMULUS
CUMULUS
STRATUS
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Section C
Fronts and Associated Weather

Overview

Introduction

In this section, we will discuss the general nature of fronts, how fronts form and move, and the weather patterns associated with the four classifications of fronts (cold, warm, stationary, and occluded).

In this section

This section covers the following topics:

Front Classification

Background

To understand fronts, we must first define and understand what an air mass is.

An air mass is any huge body of air whose physical properties (temperature and moisture) are horizontally and vertically uniform. When air stagnates over certain regions, it acquires properties from the underlying surface (source region) and forms an air mass. The prevailing weather over any area at any given time generally depends on the properties and characteristics of the prevailing air mass. In time, these air masses move out of their source region, because of the general circulation of the earth's atmosphere, the terrain, and other factors. In the northern hemisphere, cold air masses from the polar regions tend to move southward, while warm air masses from the tropical regions tend to move northward.

When two different air masses meet, the boundary or surface that separates these air masses is called a front.

Classification

Fronts are generally classified according to the relative motions of the air masses involved. The four chief classifications and their descriptions are contained in the following table:

Type	Description
Cold front	A front whose motion is such that cold air displaces warm air at the surface.
Warm front	A front whose motion is such that warm air replaces cold air at the surface.
Stationary front	A front that has little or no motion.
Occluded front	A complex front resulting when a surface cold front overtakes a warm front.

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Classification (continued)

The weather associated with fronts and frontal movement is called *frontal weather.* It is more complex and variable than air mass weather. The type and intensity of frontal weather is determined by a number of things (i.e. slope of the front, water vapor content, stability of the air mass . . .) and may range from a minor wind shift with no clouds or other visible weather activity to severe thunderstorms accompanied by low clouds, poor visibility, hail, and severe turbulence and icing. Let's consider each of the frontal categories and the weather pattern each usually produces.

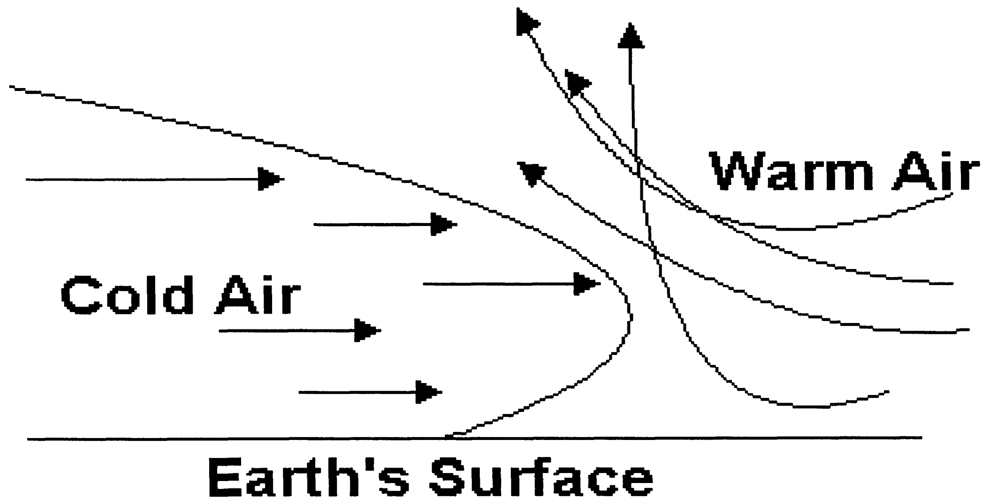
Cold Fronts

Introduction

A cold front occurs when cold air invades a region occupied by warm air.

Cold front characteristics

In a cold front, the cold air wedges under the warm air pushing the warm air upwards.



Certain weather characteristics and conditions are associated with the passage of cold fronts. In general, the temperature and humidity decrease, pressure rises, and in the northern hemisphere the wind shifts clockwise (clockwise movement on the wind direction indicator–usually from southwest to northwest) with the passage of a cold front.

When the warm air mass is unstable and moist, showers and thunderstorms occur just ahead of the front, and rapid clearing occurs behind the front. Squall lines and tornadoes are associated with fast moving cold fronts.

When the warm air is relatively dry, a cold front may not produce precipitation or clouds.

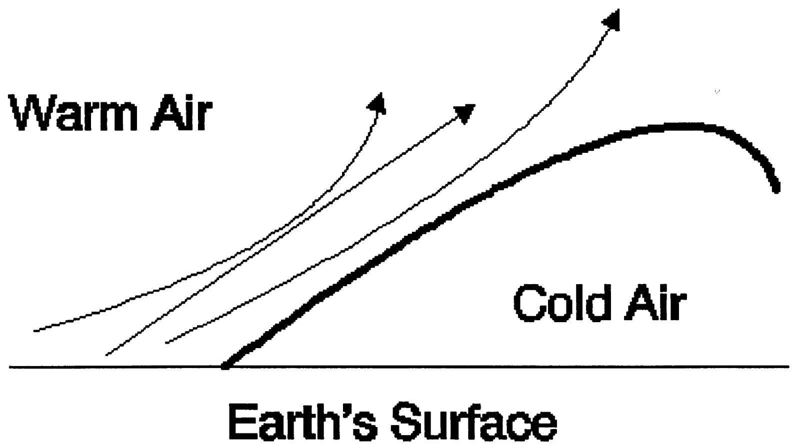
Warm Fronts

Introduction

A warm front occurs when cold air retreats before an advancing mass of warm air.

Warm front characteristics

With a warm front, the warm air slides over the cold air.



As with a cold front, the weather associated with a warm front varies depending on the degree of stability and moisture of the warm air mass.

Certain characteristics and weather conditions are associated with the passage of warm fronts. In the northern hemisphere, the winds veer from southeast to southwest or west, but the shift is not as pronounced as with the cold front. Temperatures are colder ahead of the warm front and warmer after the front passes. Clearing usually occurs after the passage of a warm front, but under some conditions drizzle and fog may occur within the warm sector. Normally, the speed of a warm front is less than that of cold fronts; the average speed of a warm front is about 10 knots.

Stationary Fronts

Introduction

Sometimes the opposing forces of different air masses are such that the frontal surface shows little or no movement. Since neither air mass is replacing the other, the front is known as a stationary front.

Stationary front characteristics

The weather conditions occurring with a stationary front are similar to those found with a warm front but are usually less intense. An annoying feature of the stationary front and its weather pattern is that it may persist and hamper flights for several days in the same area.

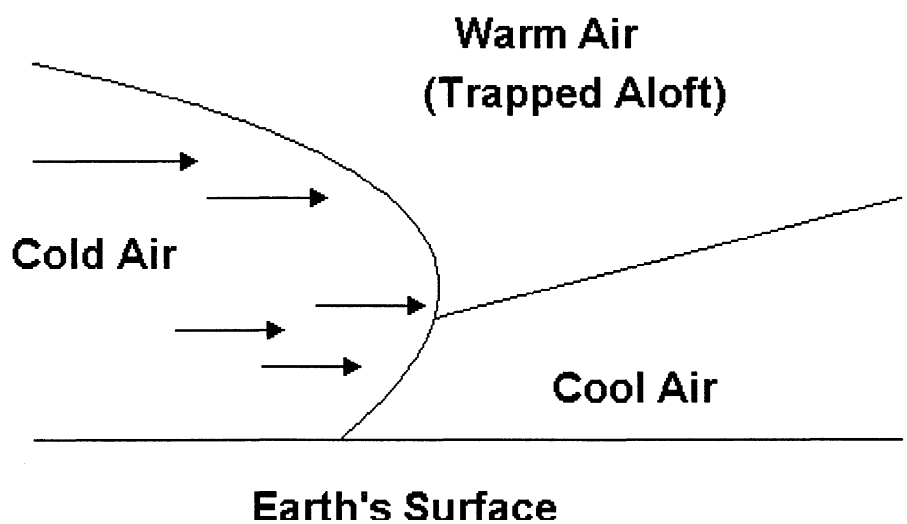
Occluded Front

Introduction

An occluded front occurs when a cold front overtakes a warm front and forces the warm front aloft as the first cold front approaches another cold front.

Occluded front characteristics

An occluded front can have the characteristics of both a warm front and a cold front depending on the position of the front and the type of occluded front (warm or cold).



Section D
Weather Hazards

Overview

Introduction

In this section, we will discuss some of the more serious weather hazards. A comprehensive knowledge of these hazards and how they affect an aircraft is essential to providing good service. This knowledge also enables you to plan ahead and keep pilots informed of known and anticipated weather conditions.

In this section

This section covers the following topics:

Fog and Precipitation

Introduction

Fog is defined as a cloud on the earth's surface. It has sufficient density in the atmosphere to interfere with visibility.

Fog consists of visible water droplets or ice particles suspended in the atmosphere. It differs from other clouds in that it exists on the ground or over the surface of bodies of water. It differs from rain or mist in that its water or ice particles are more minute and are suspended (they do not fall earthward).

Fog formation

The difference between the dew point (the temperature to which air, at constant pressure, and water vapor content must be cooled for saturation to occur) and the temperature is used to predict fog formation. The smaller the difference between the temperature and the dew point, the greater the possibility of fog formation. *Dew point spread* is the term used to describe the difference, in degrees, between the two. Fog seldom forms when the dew point spread is greater than 4° F.

Wind is another factor that influences the formation of fog. The following table shows the various wind conditions and whether or not they are favorable for the formation of fog:

Wind	Fog Formation Potential
Calm	Fog will form but is generally very shallow.
Light	With dust-laden air, is ideal for fog formation. Produces deep layers of fog.
Moderately strong	Tends to keep fog from forming as it circulates the air too rapidly for fog producing conditions to exist.
Strong	Will dissipate fog that has already formed.

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Air mass fog

Fog is divided into two classes: air mass fog and frontal fog. We will discuss each class separately since there are different requirements that govern the formation of each.

Air mass fog occurs within a given air mass and is formed when the layer of air close to the earth's surface is cooled by contact with a colder surface below.

There are four types of air mass fog. Each type gets its name from the particular manner in which air is cooled to the dew point. The four types are radiation fog, advection fog, upslope fog, and steam fog.

Type	Description
Radiation fog	More commonly known as ground fog, it is the most common problem for air traffic control. Usually forms at night and dissipates before mid morning. Best conditions for formation are a cool clear night, light wind, and high humidity.
Advection fog	Because advection fog covers large areas, it is considered ***the most dangerous to aviation.*** Forms when air moves over a land or water surface that is colder than the air mass that is passing over it.
Upslope fog	Forms when air is forced to ascend a gradual slope. Forms in very deep layers and requires considerable time to dissipate.
Steam fog	Forms when cold air moves over warm water. Evaporation from the surface of the warm water saturates the cold air and causes fog to form.

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Frontal Fog

Frontal fog is another hazard that must be added to the list of weather troubles associated with fronts. There are two classes of frontal fog: warm-front fog and cold-front fog.

Class	Description
Warm-front fog	Much more extensive than cold-front fog and is a definite hazard to flight operations. Formed by rain falling from warm air into cold air along the frontal surface.
Cold-front fog	Cold-front fog is rare. It forms in the cold air mass just behind the cold front. This type of fog dissipates rapidly due to the fast movement of cold fronts.

Precipitation

Precipitation includes all forms of moisture that fall to the earth's surface. Snow, drizzle, and rain are the most common forms of precipitation that cause a restriction to visibility.

Type	Characteristics
Snow	Usually the most effective in reducing visibility. Heavy snow and blowing snow frequently reduce surface visibility to near zero.
Rain	Rarely reduces surface visibility to below 1 mile. Has a tendency to wash dust, smoke, and fog out of the air.
Drizzle	Often accompanied by fog and results in lower visibility than rain.

Icing

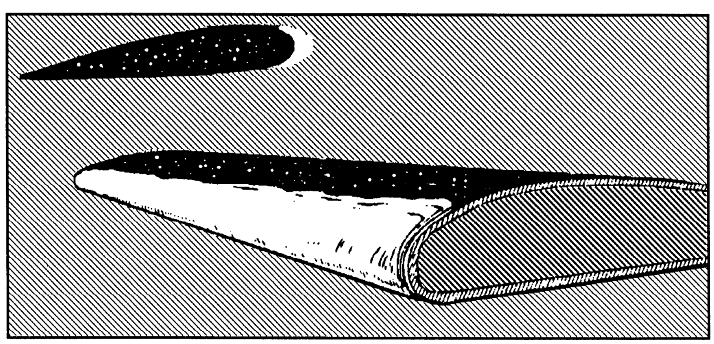
Background

A severe weather hazard to flying is airframe icing. Having a through understanding of when and how ice forms on aircraft will enable you to lend invaluable assistance to pilots.

The formation of ice on an aircraft reduces lift and thrust by adding weight to the structure and changing the airfoil shape of wings, tail, and propeller(s). There are three types of airframe ice: rime, clear (glaze), and frost. Icing conditions encountered in flight are a combination of rime and clear ice, with the characteristics of one or the other being dominant. Frost usually forms on aircraft on the ground. For the formation of ice on aircraft in flight, two conditions are necessary: the aircraft must be flying through rain, drizzle, or cloud droplets; and at the time the water droplets strike the aircraft, their temperature and the temperature of the surface of the aircraft must be 32° F or colder. Heaviest airframe icing generally occurs within the temperature range of 15°F to 32°F provided moisture is available.

Clear ice

Clear ice, sometimes referred to as glaze ice, is considered the most serious of the three types. It is clear, dense, solid, and adheres firmly to the structure upon which it forms. If the water droplets strike an aircraft in such rapid succession that none has a chance to freeze before the next strikes in the same place, the leading edges of the aircraft structures are kept covered by a film of liquid water. This film of water, cooled by contact with the colder air and by partial evaporation, freezes from the inside out, forming a clear, dense, strong layer of ice attached to the wing or other surfaces upon which it is freezing. Clear ice on an airfoil is depicted below.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Clear ice (continued)

Some of the conditions that produce a liquid film of water on aircraft favorable to the formation of clear ice are:

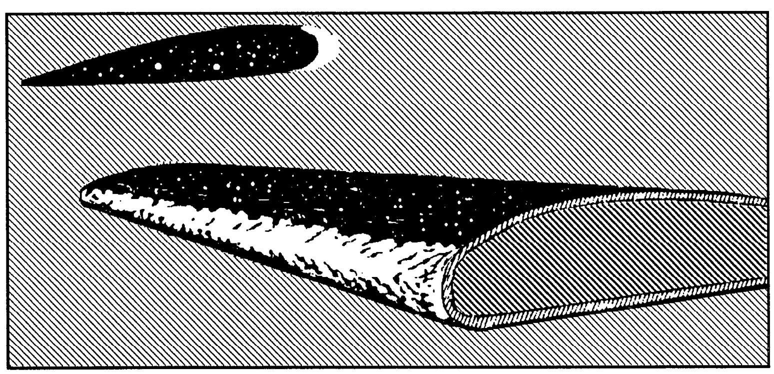
- Large water droplets such as are found in cumuliform clouds
- Large number of cloud droplets (dense clouds)
- Temperature just slightly below freezing
- An unstable or conditionally unstable air mass

Clear icing does not seriously distort airfoil shape but can add appreciably to the aircraft's weight.

Rime ice

Rime ice is a rough, whitish, opaque deposit of ice formed from tiny super-cooled water drops found in the stratiform clouds of stable air. Rime ice usually occurs at a lower temperature than does clear ice.

Unlike clear ice, rime forms as each super-cooled water droplet that strikes the airfoil freezes completely before another strikes in the same place. The resulting deposit is tiny pellets of ice frozen together in a spongy mass. Rime ice on an airfoil is depicted below.



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Rime ice (continued)

The conditions that favor the formation of rime ice are:

- Very small water droplets such as are found in stratiform clouds
- A relatively small number of water droplets that are found in clouds that are not dense
- Temperatures far below freezing

Rime ice weighs less than clear ice, but rime ice may seriously distort airfoil shape and thereby diminish lift.

Frost

Frost is a light, whitish, feathery crystalline ice, snow-like in character. It forms a dangerous coating on an aircraft surface that adds drag and alters the aerodynamic characteristics of the aircraft. Frost occurs when the temperature on the surface of the aircraft is below freezing at the time condensation takes place. This icing condition usually forms on aircraft on the ground. It can also form on airborne aircraft if the aircraft very quickly flies from a region where the temperature is well below freezing to a region where the temperature is considerably higher and the air is very moist.

Carburetor icing

In addition to the three types of airframe icing, another type of icing that merits discussion is carburetor icing. Carburetor icing occurs over a wide range of temperatures and gives the effect of slowly closing the throttle. Carburetor ice forms when the vaporization of fuel is combined with the expansion of air as it passes through the carburetor, and it can cause a complete engine failure.

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Icing intensities

Aircraft icing is classified into four intensities for reporting purposes. The following table contains the four intensity categories and a brief description of each:

Intensity	Description
Trace	Ice has become perceptible. Unless encountered for an extended period of time (over 1 hour), it is not hazardous even though deicing/anti-icing equipment is not used.
Light	The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.
Moderate	The rate of accumulation is such that even short encounters become potentially hazardous and the use of deicing/anti-icing equipment or flight diversion is necessary.
Severe	The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.

Turbulence

Introduction

An unseen but most dangerous condition to aircraft is turbulence. The effect of turbulence on aircraft ranges all the way from a few annoying bumps to severe jolts. Some types of turbulence have caused aircraft in flight to break up and disintegrate. Your job requires that you collect data on turbulence and issue advisories as appropriate.

Types and causes of turbulence

Naturally caused turbulence may exist with or without cloud conditions. Turbulence in clouds, such as that associated with thunderstorms, is extremely dangerous. Turbulence is reported in varying degrees of intensity. The classification of intensities are light, moderate, severe, and extreme.

In general, there are four causes for the development of natural turbulence.

Type	Cause
Mechanical	Caused when wind flow is disturbed and transformed into irregular movements. Air near the surface flows over obstructions, such as irregular terrain (hills and mountains) and buildings.
Frontal	Caused by the lifting of warm air by moving cold fronts. The most severe turbulence is caused by fast-moving cold fronts that contain moist air.
Thermal	Occurs when cold air moves over warmer ground which causes localized vertical air movements.
Wind Shear	This is a severe change in either wind speed or direction. An extreme form of wind shear that can be hazardous to aircraft operation sometimes forms close to the surface. An example of this is found when a pocket of cold air remains near the surface while the air above it has remained warm. Between the two layers, a narrow band of very turbulent air forms. Aircraft passing through this area often encounter considerable turbulence. Wind shear at higher altitudes is referred to as clear air turbulence (CAT).

Continued on next page

Degrees of turbulence

As stated earlier, turbulence is classified and reported in degrees or intensities. To further clarify this, the following table gives a brief description of these intensities:

Classification	Description
Light	Momentarily causes slight changes in altitude and/or attitude (pitch, roll, or yaw).
Moderate	Similar to light turbulence but of greater intensity, although the aircraft remains under control. At times, a pilot will report light or moderate chop. This refers to the type of turbulence that causes a rhythmic bumpiness with little attitude change. The term *chop* is used only with light or moderate turbulence.
Severe	Causes large abrupt changes in altitude and/or attitude. Aircraft may be momentarily out of control.
Extreme	Causes aircraft to be violently tossed about. Aircraft may be practically out of control.

In any case of reported turbulence, relay the information to other pilots in the area and to the station weather office for dissemination. Aircraft type is important when you deal with turbulence reports since intensities are based on aircraft reaction to the turbulence. A report of moderate turbulence reported by a Cessna 150 would cause little concern to a C5A pilot.

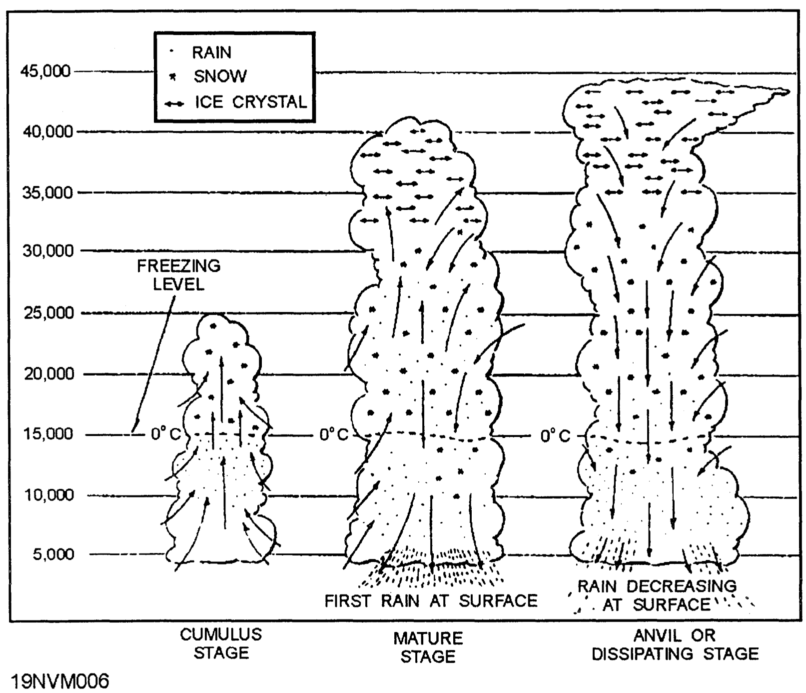
Thunderstorms

Introduction

The thunderstorm is an extremely violent and formidable weather hazard. Thunderstorms are almost always accompanied by strong gusts of wind, severe turbulence, and occasionally, hail. You must relay thunderstorm information to a pilot and occasionally advise or assist a pilot on thunderstorm avoidance. The turbulence within most thunderstorms is considered one of the worst hazards of flying.

Thunderstorm stages

The life cycle of a thunderstorm cell consists of three distinct stages: the cumulus stage, the mature stage, and the anvil or dissipating stage. These stages are depicted below.



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Thunderstorm stages (continued)

Cumulus Stage: Although most cumulus clouds do not become thunderstorms, the initial stage of a thunderstorm is always a cumulus cloud. The chief distinguishing feature of this cumulus or building stage is an updraft which prevails throughout the entire cell. Such updrafts vary in speed from a few feet per second to as much as 100 feet per second in mature cells.

Mature Stage: The beginning of surface rain with adjacent updrafts and downdrafts, initiates the mature stage. By this time, the peak of the average cell has attained a height of 25,000 feet or more. As the raindrops begin to fall, the frictional drag between the raindrops and the surrounding air causes the air to begin a downward motion. The descending saturated air soon reaches the level where it is colder than its environment. At this level, its rate of downward motion is accelerated. This accelerated downward motion is a downdraft.

Anvil or Dissipating Stage: Throughout the life span of a mature cell, as more and more air aloft is being dragged down by falling raindrops, the downdraft spreads out to take the place of the dissipating updraft. As this process progresses, the entire lower portion of the cell becomes an area of downdraft. Since this is an unbalanced situation and the descending motion in the downdraft effects a drying process, the entire structure begins to dissipate. The high winds aloft have now carried the upper section of the cloud into the anvil form, indicating that the cell is starting to dissipate.

Continued on next page

Thunderstorm weather

It is important that you be familiar with the following information provided on thunderstorm weather. This knowledge will assist you in providing service to pilots that are in or around a thunderstorm.

Rain: Precipitation in a storm may be ascending if encountered in a strong updraft. The precipitation may be suspended, seemingly without motion yet in extremely heavy concentrations, or it may be falling to the ground. A pilot could enter a cloud and be swamped by rain even though none has been observed from surface positions. Rain is found in almost every case of cloud penetration below the freezing level. Where no rain is encountered, the storm probably has not developed into the mature stage.

Hail: Hail of various sizes is present within most thunderstorm cells. The presence of damaging hail within the cloud and under the cloud should always be considered with moderate or severe storms. Hail may be encountered up to 25 miles downstream (ahead) of a thunderstorm in the clear air under the thunderstorm anvil.

Turbulence: Moderate to severe turbulence may be encountered up to 20 miles from the center of severe storms at any altitude and up to 10 miles from the centers of less severe storms. Severe or extreme turbulence is most often found in the anvil cloud 15 to 20 miles ahead of the storm center at all altitudes within the cloud. Because of the strong up and downdrafts associated with a thunderstorm, there is always a possibility of severe low-level wind shear.

Lightning: The electricity generated by a thunderstorm is rarely a great hazard to an aircraft from the standpoint of its airframe, but other lightning hazards include temporary blindness, damage to navigational and electronic equipment, and punctures to the aircraft's skin. Lightning occurs within the cloud, including the anvil portion, and is most frequent near the freezing level. Lightning also occurs between adjoining clouds and between the cloud and the ground. Although lightning frequently exits the cloud base, it may exit the side of the cloud and strike the ground up to 12 miles away from the cloud.

Continued on next page

Thunderstorm weather (continued)

Icing: Both rime and clear icing may be encountered. Clear ice accumulation in thunderstorms above the freezing level can be so rapid that an aircraft may become incapable of maintaining level flight.

Effect on Altimeters: Pressure usually falls rapidly with the approach of a thunderstorm. It rises sharply with the onset of the first gusts and the arrival of the cold downdraft and heavy rain showers. The pressure then falls back to the original pressure as the rain ends and the storm moves on. This cycle of pressure change may occur in 15 minutes. Of greatest concern are pressure readings that are too high. If you had issued an altimeter setting to an arriving aircraft during the peak of a storm, the aircraft could be too high on his approach.

Surface Wind: A significant hazard associated with thunderstorm activity is the rapid change in surface wind direction and speed immediately prior to storm passage (first gust). The strong winds at the surface that are accompanying thunderstorm passage are the result of the horizontal spreading out of downdraft currents from within the storm that occurs as these currents approach the surface of the earth. The total wind speed is a result of the downdraft divergence plus the forward velocity of the storm cell. Thus, the wind speeds at the leading edge of the cell are greater than those at the trailing edge. During the passage of a thunderstorm cell, winds shift and become strong and gusty. Also, wind speeds occasionally exceed 55 knots.

Section E
Weather Observation Codes and Phraseology

Overview

Introduction

Accurate knowledge of developing weather conditions within your airfield or ship's area of concern is critical to flying safety. You will base many operational decisions on the current and forecast weather situation.

ACs are concerned mostly with weather conditions in the immediate vicinity and within 50 miles of the airport. You use weather observations and forecasts regularly for planning purposes. You are more concerned with present weather conditions and those weather conditions expected within the hour.

In this section, we will discuss the weather support products and code forms that you will most frequently encounter and need to interpret.

In this section

This section covers the following topics:

Support Functions

Introduction

Aviation weather support is provided to each naval air station by the Naval Meteorology and Oceanography Command.

Aviation weather support

Most naval air stations are supported by meteorological detachments or facilities staffed with forecasters and observers trained to provide accurate observations of the current weather. These facilities also provide TAFs, tailored computer flight plans, general weather forecasts, and Flight Weather Briefings, DD Form 175-1.

You will find it necessary to interpret weather observation codes and the TAF. These code formats are used to report current and forecast conditions at your airfield and surrounding airfields, and are also used to report expected conditions recorded on the DD Form 175-1.

Aboard ship, the CVs, LHAs, and LHDs all have a complement of AGs assigned to provide similar services. The AGs are available to discuss the weather and any question you may have about the observation or forecast codes.

Aviation Routine Weather Reports

Introduction

The two types of weather observations used in the United States are METAR and SPECI. To perform effectively as an AC, you must be familiar with weather observation terminology and codes. Pilots rely heavily on weather information in all phases of their flight, and you, as a controller, are responsible for relaying this information.

METAR and SPECI observations

The table below shows an example of a typical METAR or SPECI observation and describes each separate section of the observation. METARs are issued for each station in the U.S. at least once each hour when the airfield is open. Because of this, these observation are sometimes called *hourly observations.* SPECIs are issued whenever significant changes occur to specific weather elements between observation periods.

Actual Report Example:
METAR KNPA 210955Z COR 07020G35KT 11/2SM R10L/2000FT +RAGR SQ FG SCT015 BKN030 02/M08 A2999

1 2 3 4 5 6
(METAR) (KNPA) (2109552) (COR) (07020G35KT) (1 1/2SM)
7 8 9 10 11
(R10L/2000FT) (+RAGR SQ FG) (SCT015 BKN030) (02/M08) (A2999)

Section	Description
1	Type of report (METAR/SPECI).
2	Station identifier.
3	Date and time of report. Recorded in UTC and based on 24-hour clock.
4	Report modifier (AUTO or COR).
5	Wind group.
6	Visibility group.
7	Runway visual range group.
8	Present weather group.
9	Sky condition group.
10	Temperature and dew point group.
11	Altimeter setting group.

Continued on next page

Type of report

Aviation weather observations are classified as either a METAR or a SPECI. A METAR is a routine scheduled report used for reporting surface meteorological data.

A SPECI contains all the data elements found in a METAR, but it's an unscheduled report. A SPECI is taken when a significant change in weather occurs between the METAR observation periods.

A METAR or SPECI has two sections: the *body* that consists of a maximum of 11 groups, and the *remarks* that consists of a maximum of three categories of remarks.

Station identifier

A four-letter identifier identifies the station sending a METAR or SPECI report. Location identifiers are found in *Location Identifiers,* FAA Order 7350.6. International identifiers can be found in ICAO Document 7910.

Date and time of report

Six digits representing the actual date and time of the report followed by Z to denote UTC. The first two digits indicate the day of the month; the second two, the hour; the last two, the minutes.

Report modifier

A report modifier is not required on every report. The absence of a modifier means that the report is either a manual report or an augmented report. *AUTO* indicates the information came from an automated station. *COR* indicates a correction to a previously issued METAR or SPECI.

Wind group

Wind information is normally encoded in a five- or six-digit group representing the direction and speed of the wind. The wind character, such as a gust, is reported in a METAR or SPECI as the wind changes require.

The direction **from** which the wind is blowing is the wind direction reported. A north wind means that the wind is blowing from the north. Wind direction is reported in tens of degrees starting at true north (360°) and moving clockwise from east to west. When wind direction is encoded, three digits are used: "010" represents 010°, "100" is 100°, "280" is 280°, etc. "000" means a calm or no-wind situation.

Continued on next page

Wind group (continued)

Variable wind direction is encoded in two formats; one for wind speeds of 6 knots or less, and one for wind speeds of 7 knots or more.

For example, if the wind direction cannot be determined and the wind speed is variable at 4 knots, the wind is encoded as "VRB04KT". For a wind that varies between 160° to 250° at 12 knots, the wind is encoded as "21012KT 160V250."

Wind speed is given in knots. The speed reported is actually the average speed for a period of time, usually 2 minutes. Wind speed is encoded using two or three digits immediately following the wind direction. When the wind is calm, the speed is encoded using "00." The encoded group for a calm wind would be "00000KT" in a METAR or SPECI.

The character of the wind refers to the increase and decrease or variability of speed in gusts.

Gust: A gust is a change in speed of 10 knots or more between peaks and lulls. The speed of the gust is the maximum instantaneous wind speed recorded during the most recent 10 minutes of the actual time of the METAR or SPECI. Gusts are encoded by suffixing the letter *G* to the average speed followed by the peak speed in the gusts.

For example, if the wind is from 070°, the average being 20 knots with gusts of 35 knots, this wind group would appear as "07020G35KT."

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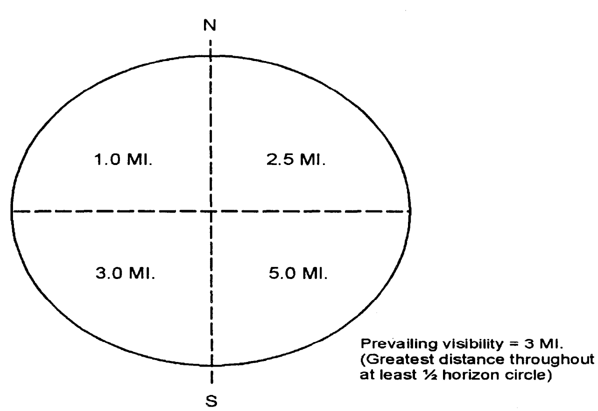
Visibility group

Visibility is an extremely important factor in the decisions you will be making that involve air traffic control. For this reason, your visibility reports must be timely and accurate.

Visibility is the greatest distance that selected objects can be seen and identified. Visibility is reported in statute miles (nautical miles on board ships) and fractions thereof up to 3 miles, the nearest whole mile from 3 to 15 miles, and the nearest 5 miles beyond 15 miles. Because of horizon limitations, 7 miles is considered unrestricted. Few stations can see beyond 7 miles.

When you are assigned to a control tower, you are required to take visibility observations when the visibility is less than 4 miles. You will be given an examination (administered by the weather personnel) and certified as a visibility observer. From the control tower, you are able to observe rapidly changing conditions and inform weather personnel and pilots of deteriorating conditions that may affect the safe operation of aircraft.

Prevailing visibility is reported in the hourly aviation weather report or METAR. Prevailing visibility is the greatest distance that you can see throughout at least half of the horizon circle. The half of the horizon circle need not necessarily be continuous. The diagram below indicates how to obtain prevailing visibility from the horizon circle.



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Visibility group (continued)	When the prevailing visibility or tower visibility is 4 miles or less and the tower visibility differs from the prevailing visibility, the tower visibility is placed in the remarks section of a METAR or SPECI. In this case, the tower visibility is used to determine aircraft approach and departure weather minimums. **NOTE:** The tower visibility is a prevailing visibility. The difference is the prevailing visibility in the body of a METAR is the visibility value observed at the surface observation point. Whereas, the tower visibility is a prevailing visibility observation taken at the tower cab level. Both are prevailing visibilities.
Runway visual range group	The RVR is an instrumentally derived value that represents the horizontal distance a pilot will see down the runway from the approach end.

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Present weather group

The present weather group is entered in a METAR or SPECI immediately following the RVR group. However, if RVR is not reported, the present weather group follows the visibility group.

The present weather group consists of weather phenomena and associated qualifiers. Weather phenomena is broken down into three groups—precipitation, obscurations, and other phenomena. The table below lists the various weather phenomena by group.

Precipitation	Obscuration	Other
DZ — Drizzle	BR — Mist	PO — Well-Developed Dust/Sand Whirls
RA — Rain	FG — Fog	SQ — Squalls
SN — Snow	FU — Smoke	FC — Funnel Cloud
SG — Snow Grains	VA — Volcanic Ash	SS — Sandstorm
IC — Ice Crystals	DU — Widespread Dust	DS — Duststorm
PE — Ice Pellets	SA — Sand	
GR — Hail	HZ — Haze	
GS — Small Hail and/or Snow Pellets	PY — Spray	

NOTE: The code +FC indicates tornadoes and waterspouts.

NOTE: When an automated weather station is unable to determine the type of precipitation, the station uses the code UP to indicate unknown precipitation.

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Present weather group (continued)

Qualifiers fall into two categories—intensity or proximity and descriptors. Intensity is either light (-), moderate, or heavy (+). The absence of a qualifier denotes a moderate intensity. The only proximity qualifier is vicinity (VC). Descriptors are listed in the following table:

Descriptors	
MI - Shallow	BL - Blowing
PR - Partial	SH - Shower(s)
BC - Patches	TS - Thunderstorm
DR - Low Drifting	FZ - Freezing

The table below displays some examples of qualifiers and weather phenomena together.

Type of Phenomenon	Coding
Well-developed tornado or waterspout	+FC
Rain shower	SHRA
Freezing rain	FZRA
Freezing drizzle	FZDZ
Light rain	-RA
Snow showers	SHSN
Shallow (ground) fog	MIFG
Partial fog	PRFG
Blowing sand	BLSA
Low drifting snow	DRSN
Fog in the vicinity	VCFG

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Sky condition group

To help explain the different parts of the cloud group, we will use the example SCT015 BKN030.

The numbers in the above example indicate the height of the cloud layer or vertical visibility into the layer. This number is in hundreds of feet AGL, so the number 015 would be 1,500 feet AGL and the 030 would be 3,000 feet AGL.

Sky cover classifications describe cloud layers or obscuring phenomena. Classifications such as SCT and OVC indicate sky cover. To determine the correct classification, weather personnel divide the sky into eighths and figure out how much of the sky is covered. Then, the correct classification is selected. The following table provides the classification, its meaning, and the associated amount of sky coverage:

Classification	Meaning	Sky Cover Amount
SKC	Sky clear	0/8
FEW	Trace	> 0/8 - 2/8
SCT	Scattered	3/8 - 4/8
BKN	Broken	5/8 - 7/8
OVC	Overcast	8/8
VV	Vertical visibility	8/8 Used with surfaced-based obscuring phenomena

Temperature and dew point group

The temperature and the dew point are encoded to the nearest whole-degree Celsius using two digits. If either the temperature or dew point is below zero, it is preceded by a capital letter "M."

For example, a temperature of 2°C with a dew point of -8°C is encoded as "02/M08."

When the temperature is not available, this group is not encoded. When the dew point is not available, the temperature is encoded as "02/."

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Altimeter

The altimeter is a measurement of the atmospheric pressure in inches of mercury reported to the nearest hundredth of an inch. This altimeter setting is what the pilot sets into his or her aircraft altimeter. It will indicate the altitude above MSL of the aircraft at the location for which the value was determined. An altimeter value of 29.99 is encoded as "A2999."

Remarks and additive data

In addition to the regularly reported data, A METAR or SPECI contains a remarks section at the end of the sequence. The three categories of the entries in the remarks section that you need to be aware of are as follows:

- Remarks about surface-based obscuring phenomena that identify the type of phenomena obscuring the sky and the amount of the sky covered.
- Remarks made to elaborate on any of the coded data in the observation report. Generally, these remarks are made to amplify significant weather in the observation report.

- Runway surface condition (RSC) and average runway condition readings (RCR) codes. RSC and RCR codes are included in the remarks section whenever conditions on the runway produce less than the normal braking conditions for landing aircraft. Different codes may be combined and each condition should be followed by a decelerometer value. A decelerometer is a device use to determine braking action. The following table describes how RCRs relates to braking action and landing roll:

RCR	Equivalent Braking Action	Percent increase in Landing Roll
02 to 05	Nil	100 or more
06 to 12	Poor	99 to 46
13 to 18	Fair (Medium)	45 to 16
19 to 25	Good	15 to 0

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Remarks and additive data (continued)

The following table lists codes used to describe runway conditions and their meanings:

Code	Meaning
WR	Wet runway
SLR	Slush on runway
PSR	Packed snow on runway
LSR	Loose snow on runway
IR	Ice on runway
RCRNR	Braking action is impeded but base operations is closed and decelerometer readings are not recorded

These codes can be appended by a capital letter "P" for patchy or the word "SANDED" when the runway has been treated with sand or other friction enhancing materials. The symbol "//" is used to indicate a runway is wet, slush covered, or that a decelerometer reading is not available. The following table lists some examples of RSC coding and their meanings:

Code	Meaning
PSR10	Packed snow on runway, decelerometer reading 10.
IR//	Ice on runway, no decelerometer reading available.
LSR05P DRY	Loose snow on runway, decelerometer reading 05, patchy, rest of runway dry.
PSR10 HFS IR06	Packed snow on runway, decelerometer reading 10 on touchdown portion. The rollout portion is a high friction surface (HFS) with ice on the runway, decelerometer reading 06.

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Aviation Routine Weather Reports, Continued

Remarks and additive data (continued)

As you can see, aviation routine weather report coding is complex, and there are elements that have not been covered in this section. The *Surface METAR Observations User's Manual,* NAVMETOCCOMINST 3141.2, and *Surface Weather Observing-METAR,* FAA Order 7900.5A, should be consulted if you have any questions on entries or codes.

Phraseology

You must transmit weather information to pilots via radio. The following table lists examples of weather report coding and the phraseology that you use when you broadcast weather reports using standard FAA voice procedures. For a more extensive listing, refer to *Flight Services,* FAA Order 7110.10.

Example	Phraseology
07020G35KT	Wind zero seven zero at two zero gusts three five
00000KT	Wind calm
31008KT	Wind three one zero at eight
27011G20KT 280V350	Wind two seven zero at one one gusts two zero; wind variable between two eight zero and three five zero
VRB04KT	Wind variable at four
1 1/2SM	Visibility one and one-half
1/16SM	Visibility one sixteenth
14SM	Visibility one four
+RAGR	Heavy rain, hail
-FZRAPE	Light freezing rain, ice pellets
FEW010	Few clouds at one thousand

Continued on next page

Phraseology (continued)

Table continued from page 1-E-13.

Example	Phraseology
SCT015 BKN030	One thousand five hundred scattered, ceiling three thousand broken
BKN010	Ceiling one thousand broken
SCT025 OVC300	Two thousand five hundred scattered, ceiling three zero thousand overcast
02/M08	Temperature two, dew point minus eight
17/15	Temperature one seven, dew point one five
A2999	Altimeter two niner niner niner
A3017	Altimeter three zero one seven

Weather Observation Systems

Introduction

Many airports throughout the National Airspace System are installing automated weather observation systems. Using sensors, these systems obtain and broadcast valuable meteorological data to aircraft. This weather information can be extremely important to aircraft operating in and out of uncontrolled airports. Two such systems are the Automated Weather Observation System (AWOS) and the Automated Surface Observation System (ASOS).

AWOS

AWOS is a real time system consisting of various sensors, a processor, a computer generated voice subsystem, and transmitter to broadcast local minute-by-minute weather directly to aircraft. AWOS has four operational levels.

- **AWOS-A** reports only altimeter settings.
- **AWOS-1** reports the altimeter setting, wind data, temperature, dew point, and density altitude.
- **AWOS-2** reports all the information provided in AWOS-1 plus visibility.
- **AWOS-3** reports all the information provided in AWOS-2 plus cloud and ceiling data.

AWOS broadcast

AWOS information is transmitted over a discrete radio frequency or the voice portion of a local NAVAID. The system transmits a 20 to 30 second weather message each minute. These messages are updated each minute and are receivable within 25 nm of the AWOS site at altitudes at or above 3,000 feet AGL.

ASOS

ASOS is designed to support aviation operations and weather forecast activities. This system provides continuous minute-by-minute observations and performs the basic observing functions necessary to generate an METAR. The ASOS consists of sensors, data collection packages, a acquisition control unit, and peripherals and displays.

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ASOS (continued)

Two types of automated ASOS stations exist.

- **AO1** for automated weather reporting stations without a precipitation discriminator.
- **AO2** for automated stations with a precipitation discriminator.

NOTE: A precipitation discriminator can determine the difference between liquid and frozen or freezing precipitation.

ASOS broadcast

ASOS information can be transmitted over a discrete VHF radio frequency or the voice portion of a local NAVAID. An aircraft should be able to receive these transmissions up to a maximum of 25 nm from the ASOS site and a maximum altitude of 10,000 feet AGL.

Section F
Weather Forecasts, Advisories, and Warnings

Overview

Introduction

Airfield operators, pilots, and air traffic control personnel cannot plan flight operations or workloads on existing weather conditions only; they must also rely on predicted weather conditions (forecasts). The following discussion on forecasts, advisories, pilot reports, and warnings will inform you of what is available to assist you in your planning.

In this section

This section covers the following topics:

Weather Forecasts

Introduction

In order to plan ahead at your facility, you must know what the current and predicted weather conditions will be. Forecasts are an extremely important tool. You must know what forecasts are available, how to use them, and how the forecasted weather will impact your facility in order to plan effectively.

Forecasts

Forecasts come in several forms. The following table lists forecasts to assist you in understanding the different types of forecasts that are available:

Type	Remarks
TAF	Terminal aerodrome forecast issued by the NWS for specific locations (terminal) four times a day. A TAF is valid for 24 hours. Each TAF replaces the previous TAF and is amended as needed.
FA	Area forecast issued by the NWS that covers an entire region, such as the Mid-Atlantic states. Describes anticipated cloud, weather, and icing conditions. FAs are issued four times a day and are valid for a period of 24 hours. FAs start with a synopsis, which describes the movements of significant fronts, pressure systems, and circulation patterns.
FD	Winds and temperature aloft forecast issued by the NWS twice a day. FDs assist pilots in determining estimated times of arrival and fuel consumption. FDs can also give a pilot an idea where his or her aircraft may encounter icing conditions.

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Change groups

Change groups indicate a change in any or all TAF elements from the predominant condition. Each change group indicates the time during which the changes are forecast to occur. The TAF uses four change groups as listed in the following table.

Change Group	Meaning
RAPID	A change in prevailing conditions that will take place during a period of time less than 1/2 hour.
GRADU	A change in prevailing conditions that will take place during a period of time lasting more than 1/2 hour but less than 2 hours.
TEMPO	Used to indicate *temporary* changes in a prevailing forecast condition. Each change should last less than 1 hour, and if the change is to occur more than once, the total time of all occurrences should not exceed one-half the total time covered by the forecast.
INTER	Used to indicate *intermittent* changes from a predominate forecast condition. *Intermittent* changes occur more frequently than *temporary* changes and last for shorter periods of time.

Weather Advisories

Introduction

In-flight advisories serve to notify enroute pilots of the possibility of encountering hazardous flying conditions that may not have been forecast at the time of the preflight weather briefing.

NWS Flight Advisories

The NWS issues in-flight weather advisories designated Convective SIGMETs (WST), SIGMETs (WS), and AIRMETs (WA). These advisories are often transmitted to air traffic control facilities via the flight data input/output (FDIO) system.

Advisory	Remarks
Convective SIGMET	Convective SIGMETs are issued for any of the following phenomena: ● Severe thunderstorms due to: — surface winds greater than or equal to 50 knots — hail at the surface greater than or equal to 3/4 inches in diameter — tornadoes ● Embedded thunderstorms ● A line of thunderstorms ● Thunderstorms greater than or equal to VIP level 4 affecting 40 percent or more of an area at least 3,000 square miles **NOTE:** Radar weather echo intensity levels are sometimes expressed during communications as VIP levels. VIP is derived from the component of the radar that produces the information—video integrator and processor. Since thunderstorms are the reason for issuance, severe or greater turbulence, severe icing, and low-level wind shear are implied and will not be specified in the advisory.

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NWS Flight Advisories (continued)

Advisory	Remarks
SIGMET	Weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover: • Severe and extreme turbulence or clear air turbulence not associated with thunderstorms • Severe icing not associated with thunderstorms • Dust storms, sandstorms, or volcanic ash that lower surface or inflight visibilities to below 3 miles • Volcanic eruption
AIRMET	AIRMETs are issued for all aircraft and specifically light aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMETs are issued for: • Moderate icing • Moderate turbulence • Sustained winds of 30 knots or more at the surface • Widespread area of ceilings less than 1,000 feet or visibility less than 3 miles • Extensive mountain obscurement AIRMETs are issued on a schedule basis every 6 hours with unscheduled amendments issued as required.

Pilot Reports

Introduction

Pilot reports of weather conditions encountered in-flight are called PIREPs. PIREPs are a valuable source of weather information that often would not otherwise be available. Reports concerning cloud tops, wind, icing levels, etc., are extremely valuable to weather service personnel and pilots when they are planning and executing their flights.

Soliciting PIREPS

Part of your job will be to solicit PIREPs. You must solicit PIREPs when requested or when one or more of the following conditions exists or is forecast for your area:

- Ceiling at or below 5,000 feet
- Visibility (surface or aloft) at or less than 5 miles
- Thunderstorms and related phenomena
- Turbulence of moderate degree or greater
- Icing of light degree or greater
- Wind shear
- Volcanic ash clouds
- Braking action advisories are in effect

You should relay weather information you receive from pilots to other aircraft, station weather offices, and concerned air traffic control facilities as soon as possible. PIREPs of tornadoes, funnel clouds, waterspouts, severe or extreme turbulence, hail, severe icing, and wind shears are classified as SEVERE PIREPs. You must immediately relay SEVERE PIREPs to all pilots, station weather offices, and other air traffic control facilities within your local area. For more detailed information on PIREPs, refer to *Flight Services,* FAA Order 7110.10.

Weather Warnings

Introduction

Within the United States, the NWS issues plain language Watch Area statements and Warning Area statements.

NWS Severe weather watches and warnings

When conditions are **favorable** for certain dangerous weather conditions to develop (such as flooding, flash flooding, severe thunderstorms, or tornadoes), the NWS issues a *Watch.* When any dangerous condition **has formed** and is affecting an area, the NWS issues a Warning. Weather personnel monitor Watches and Warnings and will alert you if there is a possibility that they will effect your local area. Weather personnel are also required to brief pilots on any Watches or Warnings and note them on the Flight Weather Briefing Form, DD Form 175-1.

Military watches, warnings, and conditions

Station weather personnel, independently or in conjunction with the NWS, may issue advisories or warnings, or recommend to base operations that various readiness conditions be set. Basic guidance on conditions of readiness is contained in *Warnings and Conditions of Readiness Concerning Hazardous or Destructive Weather Phenomena,* OPNAVINST 3140.24, while more specific guidance is usually found in amplifying local instructions.

Thunderstorm Conditions - There are four thunderstorm conditions: Thunderstorm II, Thunderstorm I, Severe Thunderstorm II, and Severe Thunderstorm I. Definitions for each are contained in the table below.

Condition	Definition
Thunderstorm II	Thunderstorms with winds less than 50 knots and/or hail less than 3/4 inch are **expected** to develop within 25 nautical miles (nmi) of the station within 6 hours.
Thunderstorm I	A thunderstorm with winds less than 50 knots and/or hail less than 3/4 inch has developed and is expected to move within 10 nmi of the station within the next hour.
Severe Thunderstorm II	Severe thunderstorms with winds greater than or equal to 50 knots, or hail equal to or greater than 3/4 inch, or severe thunderstorms with tornado activity are **expected** within 25 nmi of the station within 6 hours.

Continued on next page

Military watches, warnings, and conditions (continued)

Table continued from page 1-F-5.

Condition	Definition
Severe Thunderstorm I	A severe thunderstorm (winds greater or equal to 50 knots, or hail greater than or equal to 3/4 inch) has developed and is expected to be within 10 nmi of the station within 1 hour. When a tornado has developed and is expected to be close, within 10 nmi of the station, within 1 hour, the condition may be set as *Tornado I,* or a *Tornado Warning* may be issued.

Wind Conditions - There are several military conditions of readiness in use when high winds are expected at airfields. The table below lists the conditions and gives a brief definition of each.

Condition	Definition
High- Wind (Advisory) Condition II	Non-thunderstorm winds sustained between 18 and 33 knots, or numerous gusts equal to or greater than 24 knots are expected within 24 hours.
High-Wind (Advisory) Condition I	Non-thunderstorm winds sustained between 18 and 33 knots, or numerous gusts equal to or greater than 24 knots are expected within 12 hours.
Gale (Warning) Condition II	Non-thunderstorm winds sustained between 34 to 47 knots are expected within 24 hours.
Gale (Warning) Condition I	Non-thunderstorm winds sustained between 34 to 47 knots are expected within 12 hours.
Storm (Force Winds) Condition II	Non-thunderstorm sustained winds of 48 knots or greater are expected within 24 hours.

Continued on next page

Military watches, warnings, and conditions (continued)

Table continued from page 1-F-6.

Condition	Definition
Storm (Force Winds) Condition I	Non-thunderstorm sustained winds of 48 knots or greater are expected within 12 hours.

Tropical Cyclone Conditions-Tropical Cyclone is the general term used to identify any class of circulatory storm originating in the tropical region. A tropical cyclone can be a tropical storm, tropical depression, typhoon, hurricane etc. The table below lists the conditions and their definitions.

Condition	Definition
Condition V	Set for the Tropical Cyclone season from 1 June to 30 November.
Condition IV	Destructive winds are possible within 72 hours.
Condition III	Destructive winds are possible within 48 hours.
Condition II	Destructive winds are anticipated within 24 hours.
Condition I	Destructive winds are anticipated within 12 hours or are occurring.

Your station has a hurricane or tropical cyclone operation plan that specifies when various readiness conditions are set, and specifies what actions personnel are to take during each increased condition.

CHAPTER 2

AIR NAVIGATION AND AIDS TO AIR NAVIGATION

Overview

Introduction

In this chapter, you will be introduced to basic navigation, air navigation, and the equipment, charts, and publications used to facilitate air navigation. Understanding the above information is an integral part of the knowledge required to perform your duties as an air traffic controller. The more you know about what goes into planning and completing a successful flight, the better equipped you are to provide direction and offer assistance. The material in this chapter should give you a basic understanding of the principles of navigation, air navigation, and the aids that are available to assist the pilot in navigating the aircraft from one point to another.

Objectives

The material in this chapter will enable you to:

- Describe the fundamentals and terms of navigation and the fundamentals of plotting a position.
- Describe the different procedures used to plot a position.
- Identify the various aeronautical charts and publications used in air navigation, when they are updated, and the factors involved in chart construction and design.
- Describe the basic components, functions, uses, and limitations of various navigational aids as they relate to air traffic control.
- State the minimum standards required for monitors, monitor facilities, and monitoring of navigational aids (NAVAIDS).

Continued on next page

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
ADF	Automatic direction finder
AIM	Aeronautical Information Manual
ATC	Air traffic control
CH	Compass heading
DH	Decision height
DME	Distance measuring equipment
DoD	Department of Defense
ECN	Enroute change notice
FAA	Federal Aviation Administration
FCCN	Foreign clearance change notice
FCG	Foreign clearance guide
FLIP	Flight information publication
GHz	Gigahertz
Hz	Hertz
ICAO	International Civil Aviation Organization
ICN	Interim change notice to the Foreign *Clearance Guide*
IFR	Instrument flight rules
ILS	Instrument landing system

Continued on next page

Acronyms (continued)

Table continued from page 2-2.

Acronym	Meaning
IM	Inner marker, relative to the ILS
IR	IFR military training routes
MH	Magnetic heading
MHZ	Megahertz
MM	Middle marker, relative to the ILS
MSL	Mean sea level
NAS	National airspace system
NAVAID	Navigational aid
NDB	Nondirectional beacon
NIMA	National Imagery and Mapping Agency
NOTAM	Notice to airmen
OM	Outer marker, relative to the ILS
PCN	Planning change notice
RB	Relative bearing
SID	Standard instrument departure
SR	Slow speed low altitude training route
STAR	Standard terminal arrival
TACAN	Tactical air navigation
TB	True bearing
TH	True heading

Continued on next page

Acronyms (continued)

Table continued from page 2-3.

Acronym	Meaning
UCN	Urgent change notice to FLIP products
UHF	Ultra high frequency
UTC	Coordinated universal time
VFR	Visual flight rules
VHF	Very high frequency
VOR	VHF omnidirectional range
VOT	VOR test facility
VR	VFR military training route
Z	Zulu time
ZD	Zone description

Topics

This chapter is divided into four sections:

Section A
Basic Concepts of Air Navigation

Overview

Introduction

Navigation is generally defined as the process of directing movement from one place to another. Air navigation is the process of directing the movement of an aircraft from one point to another. Air navigation has borrowed and adapted many of the instruments, practices, and procedures of marine navigation; thus, basic knowledge and skills are the same for marine and air navigation. In performing your daily duties, you should have an understanding of the basic fundamentals of air navigation.

In this section

This section covers the following topics:

Position Determination

Introduction

Regardless of the specific method of navigation, or combination of methods, used by a navigator, the procedures applied must furnish a solution to the three basic problems of navigation. The three basic problems are:

1. How to determine *position*

2. How to determine the *direction* in which to proceed to get from one position to another

3. How to determine *distance* and the related factors of time and speed

Position

Of the three problems facing every navigator, determining position, direction, or distance, the most important is determining position. Unless it is known where the aircraft is located, the movements of the aircraft cannot be directed with accuracy. The term *position* refers to an identifiable location on earth or a point within a man-made system of artificial coordinates.

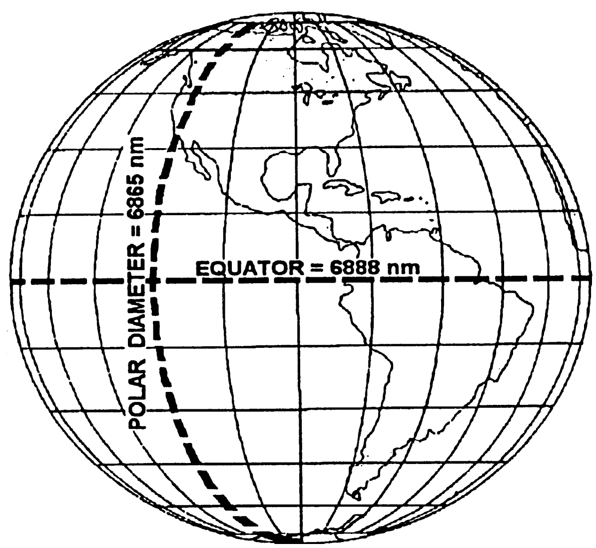
We must have a system for designating any position on the surface of earth; therefore, a map or chart is the primary tool used in navigation. Without a chart it would be impossible to navigate. It is important to understand certain facts shown on these charts about earth's surface. Some of these facts will be familiar to you and others may not. To ensure that all the facts are known about earth's surface, refer to the table on the following page.

Continued on next page

Earth facts

Before we begin to examine charts, it is important to understand the following facts about earth itself:

Facts about Earth
Earth is not a perfect sphere.
The diameter at the equator equals approximately 6,888 nautical miles.
The polar diameter is approximately 6,865 nautical miles, or 23 miles less than the diameter at the equator.
Technically, earth is shaped like an oblate spheroid (a sphere flattened at the poles).



For the purposes of navigation, we assume that we are working with a perfect sphere. The differences between the two diameters are small enough to be considered insignificant.

Nautical charts do NOT take earth's oblateness into account.

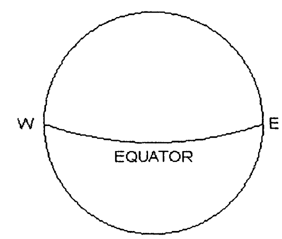
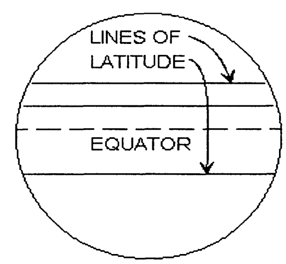
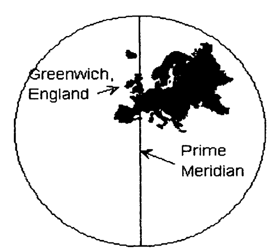
Reference Lines on Earth

Introduction

The location of any point on earth may be defined by using a system of geographic coordinates (grid) much like you would use a state or city map.

Geographic coordinates

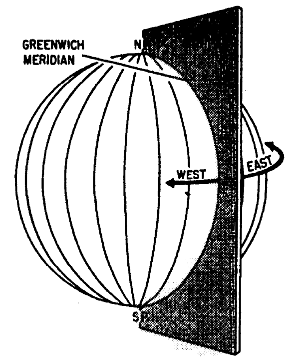
The following table contains explanations and definitions used in determining position on earth's "grid." The table should help you to understand how position can be determined for any place on earth.

Term	Definition	Example
Equator	A great circle around the earth dividing the Northern and Southern hemisphere. Starting line for latitude. A great circle is a circle that is the intersection of the surface of a sphere with a plane passing through the center of the sphere.	
Latitude (L)	Parallels of latitude (L) are used to locate points north or south from the equator (0° L) to the poles (90° L). The suffix "north" or "south" is an essential part of the description and must always be included. Parallels of Latitude are always parallel to the plane of the equator.	
Prime Meridian	A line running from the North to South Pole through Greeenwich, England. The starting point for the measurement of longitude.	

Continued on next page

Geographic coordinates (continued)

Table continued from page 2-A-4.

Term	Definition	Example
Longitude	Meridians of longitude (LO) are used to locate points east and west. Longitude is based on great circles passing through the poles. These great circles are divided in half by the poles, with each half being assigned a value of east or west. Longitude is measured in degrees of arc, from 0° to 180° east or west from the prime meridian. The suffix "east" or "west" is an essential part of the description and must always be included.	

Using a "grid" composed of lines of latitude and longitude superposed over the earth, you can understand how any point or position on earth can be accurately plotted.

Direction

Introduction

Direction is the second problem of navigation that we will discuss. Direction is defined as the position of one point in space relative to another without reference to the distance between them.

Point system

The usual reference point when discussing direction is true north, although others will be used and discussed later in this chapter. The point system for specifying a direction is not adequate for modern navigation. This system was used by simply stating the cardinal point of the compass as the direction to travel. The cardinal points of the compass are north, south, east, and west. When you use the point system, these cardinal points are modified to achieve greater accuracy, for example, northeast, north-northwest, southeast etc.

Numerical system

Today, we use the numerical system for navigation. The numerical system divides the horizon into 360 degrees, starting with north as 000 degrees and continuing clockwise through east 090 degrees, south 180 degrees, west 270 degrees and back north.

Magnetic compass

As its name implies, the magnetic compass uses the force known as magnetism. Earth has a magnetized core, two magnetic poles, and lines of force that form a magnetic field. Like any other magnet, earth also has a north magnetic pole and a south magnetic pole. Although the poles are placed at specific geographic sites on magnetic charts, the locations of the magnetic poles change slightly at times.

As in a magnet, the lines of magnetic force running between the North and South Poles create a magnetic field, which affects any magnetic substance. As a result, a freely suspended magnetic bar or needle tends to align itself with earths lines of magnetic force.

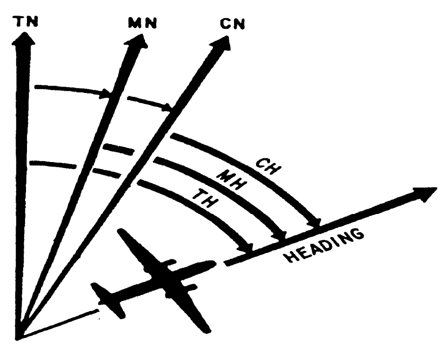
The magnetic compass retains its importance despite the invention of the gyrocompass. While the gyrocompass is an extremely accurate instrument, it is highly complex, is dependent on an electrical power supply, and is subject to mechanical damage. Conversely, the magnetic compass is entirely self-contained, fairly simple, and not easily damaged.

Continued on next page

Heading determined by a compass

Compasses are used to determine *heading,* which is the angle measured clockwise from a reference point to the longitudinal axis of the aircraft.

When the angle is expressed with relation to true north, it is known as **true heading (TH).** When it is measured from magnetic north, it is called **magnetic heading (MIS).** And should it be measured from compass north, the term used would be **compass heading (CH).** In each case, the angle is measured in a clockwise direction from the north reference to the longitudinal axis of the aircraft. You should determine which reference was used, since all references do not have the same value. This is done by designating the reference by one of the terms *true, magnetic,* or *compass.*



Variation

When a magnetized needle is influenced by earth's magnetic field, the direction it points to is magnetic north. The direction of the geographic North Pole is called true north. The angle between magnetic north and true north is termed *variation.* Variation differs at different points on earth. When the needle points to true north, then magnetic north and true north coincide and the variation is zero. When the needle points east of true north, the variation is east; when the needle points west of true north, the variation is west.

Continued on next page

Deviation

A compass, however, is affected by all magnetic fields. A piece of iron close to a compass needle tends to deflect it from magnetic north. Whenever an electric current passes through a wire, a magnetic field is set up around the wire. The combined effect of all the magnetic fields **within** the aircraft causes an error in the compass known as deviation.

Deviation varies as an aircraft changes headings because the metal structure and electrical devices turn with the aircraft, creating a different alignment relationship.

Since deviation may vary with each heading, deviation is determined for each heading that differs by approximately 15 degrees. This is done most commonly on the ground by making use of a large compass rose (a large concrete area) with magnetic headings inscribed at 15-degree increments. Deviation is checked by comparing the compass reading with the known magnetic heading. If deviation is present and the north point of the compass points eastward of magnetic north, the deviation is east; if it points westward of magnetic north, the deviation is west.

NOTE: The sum of variation and deviation is termed *compass error.*

Distance

Introduction	*Distance* is the spatial separation between two points without regard to direction. In navigation, it is measured by the length of a line on the surface of earth from one point to the other.
units of measurement	Obviously, there must be some way to accurately describe the distance traveled. The customary units are yards, miles, or kilometers. The "mile" used in navigation is the international nautical mile, 6,076 feet, which is longer than the statute mile used in land travel (5,280 feet). Also, 1 minute of arc on the equator is equal to 1 nautical mile, and 1 minute of arc on a meridian (1 minute of latitude) is equal to 1 nautical mile.

Time

Introduction

The consideration of time is always of major importance in the flight planning process. Almost every planning action is concerned in some way with the timely arrival at the destination and intermediate fixes en route.

Background

To understand the concept of time, we must have a basic knowledge of how time is derived. In the late 1800s, the development of comparatively rapid transit systems, such as the railroad and the steamship, made the development of an accurate method of keeping time a necessity. The concept that a *mean* solar day was equal to a theoretical *mean* sun passing completely around earth at the equator once every 24 hours was developed. This concept came to be widely used for marking the passage of time. One *mean* solar day is 24 hours in length, with each hour consisting of 60 minutes, and each minute, 60 seconds.Since the mean sun completes one circuit of earth (360°) every 24 hours, it follows that it moves at the rate of 15° of arc as measured at the equator, or 15° of longitude, per hour (360° ÷ 24 = 15°).

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Zone identification

The figure on the following page shows a standard time zone chart of the world. Each sector appears as a vertical band 15° of longitude in width. Notice that each zone on the chart is defined by the number of hours of difference between the time kept within that zone and the time kept within the zone centered on the prime (0°) meridian, passing through Greenwich, England. Each zone is labeled with letters, called time zone indicators, which assist in identification of the zones.

Time based upon the relationship of the mean sun with the prime meridian is called *UTC*. It is also referred to as *ZULU* time because of its time zone indicator letter (Z).

The farther to the west of Greenwich that a time zone lies, the earlier will the time kept in that zone be in relation to UTC. This is indicated by placing a plus (+) sign in front of the hourly difference figure to indicate that the hours must be <u>added</u> to the local zone time to convert it to UTC.
to the east of Greenwich a time zone is located, the later its time will be relative to UTC. This is indicated by a minus (-) sign, indicating that the hours must be <u>subtracted</u> to obtain UTC. The Greenwich zone extends 7 1/2° either side of the prime meridian. A new time zone boundary lies every 15° thereafter, across both the Eastern Hemisphere and the Western Hemisphere, resulting in the twenty-fourth zone being split into two halves by the 180th meridian. The half on the west side of this meridian keeps time 12 hours behind UTC, making its difference + 12, while the half on the east side is -12. These zones are numbered + 1 through + 12 to the west of the Greenwich zone, and -1 through -12 to the east.

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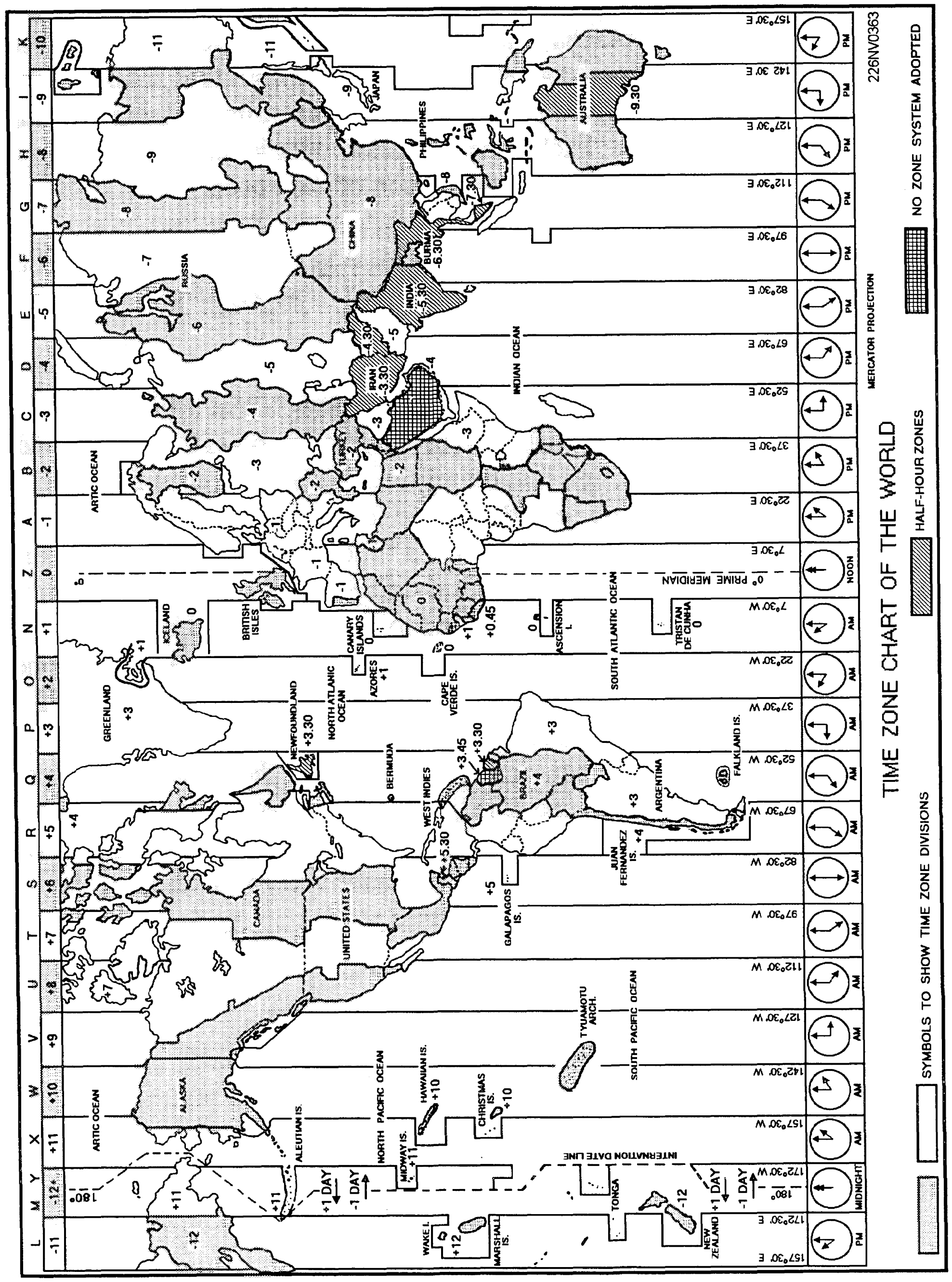
Time, Continued

Standard time zone chart



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Coordinated Universal Time	The unit of time that you will be working with is UTC. Because UTC is based on scientific computations instead of the rate of rotation and revolution of earth, the increased accuracy has enhanced air navigation.
Time conversions	As a general rule, the standard time zone in any particular position on earth can be found simply by dividing its longitude by 15. When the remainder of this division is less than 7 1/2°, the quotient represents the number of the zone; if greater than 7 1/2°, the location is the next zone away from the Greenwich meridian. When there is no remainder, the location lies exactly on the central meridian of a time zone. The sign of the zone is determined by the hemisphere in which the position is located. In the Western Hemisphere, the sign is positive (+), and in the Eastern Hemisphere, it is negative (-). Applying the proper sign to the number found by division yields the ZD. If the standard time zone where Norfolk, Virginia, is located were required, its longitude, 76° 18.0' W, would be divided by 15, to yield a quotient of 5 with a remainder of 1°18'. Notice that Norfolk is located in the +5 time zone and has the time zone indicator letter *R* assigned.
Time signals	Time in the countries of the world is determined by national observatories, such as the U.S. Naval Observatory in Washington, D.C., and the Royal Observatory in Greenwich, England. Station WWV, at Fort Collins, Colorado, and station WWVH, on the island of Kauai in Hawaii, continuously broadcast signals based on Naval Observatory time. These broadcasts may be heard with any ordinary radio receiver. Complete schedules and information on Navy time signals are in the *Flight Information Handbook.*

Section B
Elementary Plotting

Overview

Introduction

Plotting is the primary method of determining geographical position. Whether you are working in Air Operations on an aircraft carrier or Base Operations at a shore facility, the principles of plotting are the same. The information in this section will be useful to you in almost all phases of air traffic control.

In this section

This section covers the following topics:

Plotting Lines of Position

Introduction

To understand how a fix or position is determined, you must understand what lines of position (LOPs) are and how they work.

Lines of position

A fix, or accurate position, can be obtained on a chart by finding a specific landmark. When a NAVAID or radar is not used, each fix is established by two or more LOPs. A LOP may be a visible line on the ground, like a highway or another object of known position, but it is not visible until it is drawn on a chart.

To understand how LOP are obtained, let's first suppose that an aircraft is flying VFR over a railroad, but its location along the length of the railroad is not known. If the railroad can be located on the chart, a line of position can be established. Then, a second railroad that crosses the first is seen and then located on the chart. The exact location of the aircraft along the railroad is now determined. Remember, a fix is an accurate position.

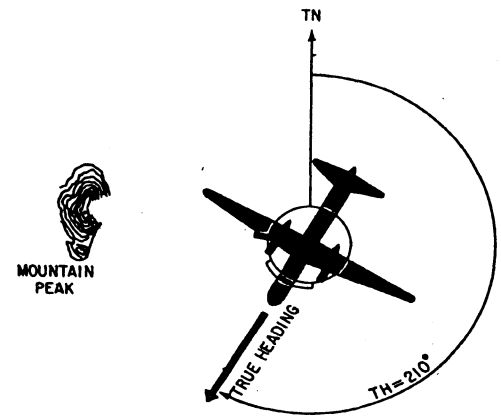
Bearings and Headings

Introduction

As an air traffic controller, you need to understand the terms *bearing* and *heading*. It is important that you understand the difference between the two and how they are used to determine LOPs, positions, and fixes.

Headings

Earlier in this chapter we talked about headings. For the purpose of this discussion we will talk about TH only. TH is the angle measured from true north clockwise to the longitudinal (fore and aft) axis of the aircraft, and it is measured in degrees from 0 to 360. The figure shows the aircraft to be on a true heading of 210°.

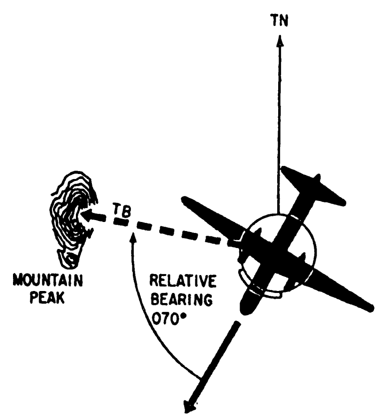


Bearings

There are two forms of bearing, true bearing (TB) and relative bearing (RB). For this discussion, we will talk about the aircraft's bearing relationship to the mountain peak depicted in the figures.

Relative bearing

RB is the angle measured from the longitudinal axis of the aircraft clockwise to a line passing through an object. Simply put, RB is the position of an object relative to the nose of the aircraft. For example, if an object was directly behind an aircraft, its relative bearing would be 180° regardless of the aircraft's heading. In the example, the mountain peak's relative bearing is 070°.



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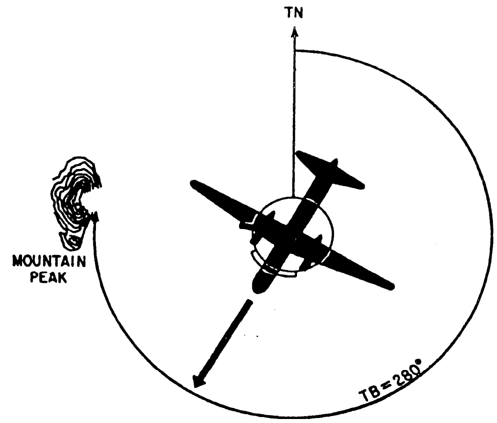
Bearings and Headings, Continued

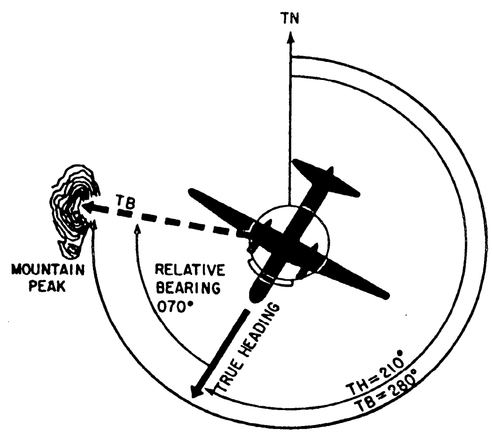
True bearings

TB is the relation of an object to the aircraft using true north as the reference point instead of the aircraft's position. TB is useful when the aircraft is turning, and it is difficult to determine the aircraft's actual heading. The figure shows the true bearing (280°.) of the mountain peak from the aircraft.



TH, RB, TB relationship

The relationship between TH, RB, and TB is shown in the figure below.



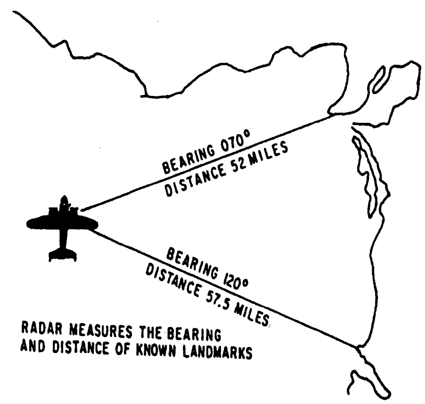
Plotting Aircraft Position Using Radar and TACAN

Introduction

An aircraft can determine its position and obtain a fix by using its airborne radar and TACAN systems.

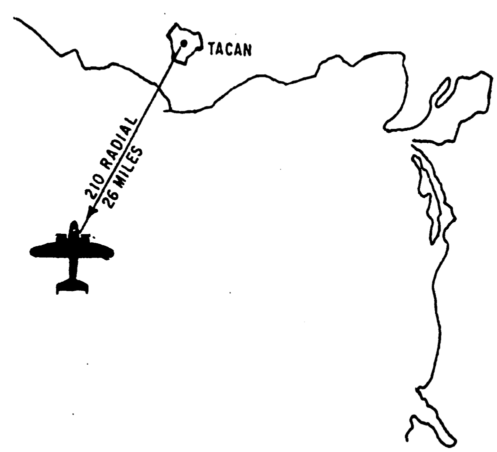
Radar fix

Airborne radar is oriented so that 360° is represented by the nose of the aircraft. By use of a radarscope in the aircraft, the relative bearing and the distance that the aircraft is from known landmarks can be determined, providing a fix. The figure to the right gives an example of a radar fix for an airborne aircraft.



TACAN fix

TACAN provides bearing and distance information. By use of aircraft instruments, the pilot can determine what TACAN radial the aircraft is on and its distance from the TACAN station. Since the position of the TACAN station is known, a fix, or the aircraft's position, can be determined relative to the TACAN station. The figure to the right shows an example of a TACAN fix.



Section C
Aeronautical Charts

Overview

Introduction

The availability of up-to-date aeronautical charts and publications at ATC facilities is important. Outdated or incorrect publications have been the source of numerous aircraft accidents. You are required to possess a thorough knowledge of the maintenance and use of those charts and publications required at your facility. The branch chief normally has the responsibility for chart and publication procurement, but all personnel of the branch should be proficient in maintaining and using charts necessary for flight safety.

In this section

This section covers the following topics:

NIMA

Introduction

The NIMA has the overall responsibility for the management and distribution of all DoD navigational charts and publications. The NIMA Order Fulfillment Department, Requisition Processing Branch (ISDFR) has several strategically located distribution control points for the distribution of all NIMA products. This branch also responds to inquiries regarding such things as ordering procedures, product availability, disposition of excess stock, and many other areas.

Chart information

The following table lists some of the more common NIMA products that you will use in your facility. The table is not a complete list of NIMA products and your facility may use other NIMA products not listed here.

Product	General Information
Catalog of Maps, Charts, and Related Products, Part I, Vol. I	Provides information on the availability and sources of supply for all aeronautical charts, special-purpose charts, FLIPs, and related products. It is published semiannually and provides product descriptions, chart indexes, ordering procedures, and information on *Automatic Initial Distribution (AID).*
Semiannual Bulletin Digest, Part 1 -Aeronautical Products	This digest is published semiannually. It provides a listing of new editions of all aeronautical charts, special purpose charts, and related products. The *Semiannual Bulletin Digest* also contains current editions of charts and publications, items being deleted, canceled charts and publications, and special notices. A new issue of the Semiannual Bulletin Digest replaces the previous issues and accumulates all changes that have occurred since the most recently issued digest.

Continued on next page

Chart information (continued)

Table continued from page 2-C-2.

Product	General Information
Aeronautical Chart Updating Manual (CHUM)	Provides the chart-user with a cumulative listing. of significant chart discrepancies that may affect flight safety. Also provides chart additions and notices of special interest to be considered when using current editions of published aeronautical charts. The manual is published semiannually and replaces all previous issues of the *CHUM Supplement* and *CHUM*
Aeronautical Chart Updating Manual (CHUM) Supplement	The *CHUM Supplement* provides the same information as the *CHUM* but is published on a monthly basis between the issue months of the *CHUM*. Each new *CHUM Supplement* includes all changes that have occurred since the most recently issued *CHUM*

Automatic initial distribution

Automatic Initial Distribution (AID) refers to the automatic issue of predetermined quantities of new or revised products. AID is the means by which your basic load of maps and charts is kept current with no action required by your command. All products in the *NIMA Catalog* are available through AID. Each user on *AID* is required to revalidate their requirements annually; a listing of requirements is furnished for this purpose.

Flight Information Publications Program

Introduction

The Flight Information Publications Program uses the concept that there are basically three separate phases of flight: flight planning, en route operations, and terminal operations.

FLIP planning

The FLIP Planning document is intended primarily for use in ground planning at base operations offices. It is arranged into four sections: (1) General Planning, (2) Area Planning, (3) Special-Use Airspace, and (4) Military Training Routes, North and South America. These books may be revised between publication dates by issuing a PCN on a scheduled basis or a UCN as required. A PCN or UCN may contain a consolidation of various changes and/or corrections to several pages of a book to preclude publishing individual replacement pages. The following table gives a brief description of the books and charts used in this area:

Book or Chart	Description
General Planning	The General Planning document has general information on all FLIPS, explanations of the divisions of Unites States airspace, terms and abbreviations, operations and firings over the high seas, and aviation weather codes. It also includes information on flight plans and pilot procedures that have common world-wide application, plus information on ICAO procedures. This book is published every 32 weeks with PCNs issued at the 16-week midpoint.
Area Planning (AP/1, 2, 3, and 4)	AP/1, 2, 3, & 4 books contain planning and procedural data for specific geographical areas of the world. With the exception of AP/4, these books are published every 24 weeks with PCNs issued at the 8- and 16-week interval points.
Area Planning (AP/1A, 2A, 3A, and 4A) (Special Use Airspace)	AP/1A, 2A, 3A, & 4A books contain information on prohibited, restricted, danger, warning, and alert areas by country. Military operations and parachute jumping areas are also listed. These books and AP/4 are published every 48 weeks with PCNs at the 16- and 32-week interval points.

NOTE: The AP/4 and AP/4A are combined into one booklet.

Continued on next page

FLIP planning (continued)

Table continued from page 2-C-4.

Book or Chart	Description
Area Planning (AP/1B) (Military Training Routes, North and South America)	This publication contains information relative to military training routes and refueling tracks for both fixed-wing aircraft and helicopters. This book is published every 8 weeks. Charts containing graphic depictions of the IR, VR, SR route systems throughout the United States and Alaska are also included.

FLIP enroute and terminal publications

FLIP enroute and terminal publications are designed to provide airway structure, radio navigation, approach, and landing information for use during the in-flight phase of IFR operations. The *DoD Enroute Supplements* (IFR/VFR) support these publications with supplemental aerodrome, facility, communication, and procedural information. The table below lists the most frequently used FLIP enroute and terminal publications.

Publication	Description
*Enroute Low Altitude Charts**	*Enroute Low Altitude* charts portray the airway system and related data required for IFR operation at altitudes below 18,000 MSL. Twenty-eight low altitude charts are available labeled L-l through L-28. L-1 through L-26 cover the entire United States; L-27 and L-28 are designed for pilots who frequently plan flights north and south along the east coast.
*Enroute High Altitude Charts**	*Enroute High Altitude* charts portray the airway system and related data required for IFR operations at and above FL 180 MSL. Six high altitude charts labeled H-1 through H-6 are available, and they can be assembled to form a wall planning chart for the high altitude airway structure.

Continued on next page

FLIP enroute and terminal publications (continued)

Table continued from page 2-C-5.

Publication	Description
*Enroute IFR Supplement**	The *Enroute IFR Supplement* is a bound booklet containing an alphabetical listing of IFR airports and facilities in the United States.
Enroute VFR Supplement	The *Enroute VFR Supplement* contains an alphabetical listing of selected United States VFR airports with sketches. This supplement is published every 24 weeks with enroute change notices (ECNs) issued at the 12-week midpoint.
Flight Information Handbook	The *Flight Information Handbook* is a DoD publication issued every 32 weeks. It contains information not subject to frequent change that is required by DoD aircrews in flight. Sections include emergency procedures, FLIP and NOTAM abbreviations and codes, national and international flight data and procedures, conversion tables, standard time signals, and meteorological information. This publication is intended for worldwide use in conjunction with *DoD FLIP Enroute Supplements.*
*Terminal High Altitude**	*Terminal High Altitude* publications contain high-altitude instrument approach procedures, airport diagrams, SIDs, and radar instrument approach minimums. *Terminal High Altitude* information for the United States is published in four booklets.
*Terminal Low Altitude**	*Terminal Low Altitude* publications contain approved low-altitude instrument approach procedures, airport diagrams, SIDs, and radar instrument approach minimums. *Terminal Low Altitude* information for the United States is published in 12 booklets. A terminal change notice (TCN) is issued at the 4-week midpoint.

Continued on next page

FLIP enroute and terminal publications (continued)

* Charts are issued every 8 weeks with an effective date. Although action is taken to update this data during the revision cycle, NOTAMS must be consulted for the latest information on changing data.

FLIP geographic areas

FLIP products are produced for the following geographical areas:

- Africa
- Alaska
- Canada and North Atlantic
- Caribbean and South America
- Eastern Europe and Asia
- Europe, North Africa, and Middle East
- Pacific, Australasia, and Antarctica
- United States

DAFIF

The Digital Aeronautical Flight Information File (DAFIF) provides worldwide digital flight information selected from the DoD FLIP. It is used for existing and developing automated applications such as flight planning systems, flight simulators, and flight management computer systems.

The output media is CD/ROM updated every 28 days. The following standard outputs are available:

- Full file high and low altitude data
- Navigational aids only
- Transaction high and low (changes to previous full-file)

Miscellaneous Flight Information Products

Introduction

There are many flight information publications, but we will only discuss *Foreign Clearance Guide, Aeronautical Information Manual,* and *Notices to Airmen.* Also, it is important to remember that this section does not contain all of the publications that you may deal with. A more extensive list is provided in the Flight Planning chapter of the *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114. Each facility will have a complete listing of all the publications that they use, and you should become completely familiar with that list.

Foreign Clearance Guide (FCG)

The FCG provides information on aircraft diplomatic clearance and entrance requirements along with special restrictions and general briefing information for all foreign nations, U.S. possessions, and U.S. controlled or administered areas outside CONUS. Amendments are issued through *Interim Change Notices (ICNs), Foreign Clearance Change Notices (FCCNs),* and revised booklets. The FCG general information sections and indexes are issued annually; revised area booklets are issued each month by specific area on a 4-month cycle. FCCNs are issued monthly and contain all permanent and temporary changes not yet published. ICNs are issued for immediate notification purposes. The FCG is broken down as follows:

- General information section
- Country index to area booklets
- Area booklets
  - Africa and Southwest Asia
  - Europe
  - North and South America
  - Pacific, South Asia, and Indian Ocean
- Index of associated publications

Continued on next page

Maintaining the FCG

Some important points concerning the maintenance of the FCG are:

- ICNs are transmitted by ROUTINE, PRIORITY, or IMMEDIATE message.
- FCCNs received by mail must be separated upon receipt and reviewed to determine which ICNs are incorporated.
- The covers of revised booklets must be read to determine which ICNs and FCCNs are incorporated.

Aeronautical Information Manual

The *Aeronautical Information Manual (AIM)* is designed to provide the aviation community with basic flight information and ATC procedures for use in the National Airspace System. You should be familiar with this manual for ready reference when assisting pilots. It contains a wealth of data related to ATC functions. The AIM is complemented by *Notices to Airmen* and the *Airport/Facility Directory* publications.

The AIM has information of a relatively permanent nature, such as descriptions of aeronautical lighting and airport visual aids; descriptions of various navigation aids with proper use procedures; procedures for obtaining weather, preflight, and in-flight services; arrival, departure, and en route procedures; emergency procedures; and a pilot and controller glossary. The AIM is published or revised approximately every 6 months.

Airport/Facility Directory (AFD)

The AFD is a 7-volume booklet series that contains data on airports, seaplane bases, heliports, NAVAIDs, communications data, weather data sources, airspace, special notices, parachute jumping areas, and operational procedures. These booklets cover the conterminous United States, Puerto Rico, and the Virgin Islands.

The AFD also lists data that cannot be readily depicted in graphic form such as airport hours of operation, types of fuel available, runway widths, and lighting codes. The AFD is published every 56 days.

Continued on next page

Sectional Aeronautical Charts

Sectional Charts are designed for visual navigation of slow- to medium-speed aircraft. The topographic information consists of contour lines, shaded relief, drainage patterns, and an extensive selection of visual checkpoints and landmarks used for flight under VFR. These charts also include cities and towns, roads, railroads, and other distinct landmarks. The Sectional Charts are revised semiannually except that most Alaskan charts are revised annually.

VFR Terminal Area Charts (TAC)

TACs depict the airspace designated as Class B airspace. These charts are similar to sectional charts but have more detail because the chart scale is larger. The TAC is designed for pilots who operate to or from airfields within or near Class B or Class C airspace. TACs are revised semiannually except Puerto Rico and Virgin Island charts are revised annually.

U.S. IFR/VFR Low Altitude Planning Chart

The IFR/VFR Low Altitude Planning Chart is designed for preflight and enroute flight planning for IFR and VFR flights. This chart depicts low altitude airways and mileage, NAVAIDs, airports, special use airspace, cities, time zones, major drainage, a directory of airports with their airspace classification, and a mileage table showing great circle distances between major airports. Planning charts are revised annually.

U.S. Terminal Procedures Publication (TPP)

TPPs are published in 20 volumes covering the conterminous United States, Puerto Rico, and the Virgin Islands. TPPs include:

- Instrument Approach Procedure (IAP) Charts
- Standard Instrument Departure (SID) Charts
- Standard Terminal Arrival (STAR) Charts
- Airport Diagrams

Continued on next page

Digital Aeronautical Chart Supplement (DACS)

The DACS is designed to be used with aeronautical charts for flight planning purposes only—it should not be used as a substitute for a chart. DACS are produced every 56 days and reflect digitally what is shown on the enroute high and low charts. The DACS has nine sections.

- Section 1: High altitude airways, conterminous U.S.
- Section 2: Low altitude airways, conterminous U.S.
- Section 3: Selected instrument approach procedure, NAVAID, and fix data
- Section 4: Military training routes
- Section 5: Alaska, Hawaii, Puerto Rico, Bahamas, and selected oceanic routes
- Section 6: STARs
- Section 7: SIDs
- Section 8: Preferred IFR routes (low and high altitude)
- Section 9: Air route and airport surveillance radar facilities

Section D
Navigational Aids

Overview

Introduction

Various types of air navigation aids are in use today, each serving a special purpose in the total system. Although they have varied owners, the FAA has the statutory authority to establish, operate, and maintain a common system of air navigational facilities, and to prescribe standards for the operation of any aids used for IFR flight in controlled airspace. This common system is referred to as the National Airspace System (NAS).

Knowledge of the basic theory of radio, applicable to both communications and air navigation equipment, increases your understanding of the uses and limitations of radios and how they interface within the NAS.

In this section

This section contains the following tonics.

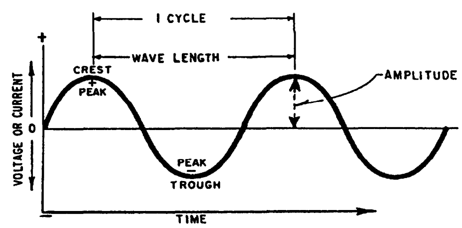
Radio Theory

Introduction

To understand the information in this section, it is essential for you to have a basic understanding of radio theory and the principles involved.

Frequency

Radiated electromagnetic energy suitable for radio communication is called a *Hertzian wave.* This wave can be represented as a sine curve. The top of the wave represents the maximum positive value, and the bottom represents the maximum negative value. Either maximum may be called a peak. *Wavelength* is the distance between corresponding points on consecutive waves, or the distance a wave travels during- one cycle. *Frequency* is the number of cycles that occur per second, stated in terms of hertz and abbreviated Hz; the thousands of cycles per second, stated in kilohertz, abbreviated kHz; the millions of cycles per second, stated in megahertz, abbreviated MHz; or the billions of cycles per seconds, stated in gigahertz, abbreviated GHz.



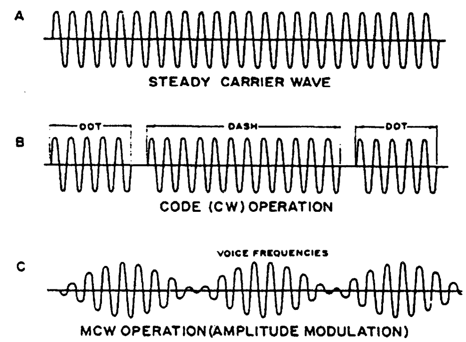
The radio frequency spectrum extends from approximately 10 kHz to 300,000 GHz.

Frequency range	Name of the Range	Symbol
30—300 kHz	Low frequency	LF
300—3,000 kHz	Medium frequency	MF
3—30 MHz	High frequency	HF
30—300 MHz	Very high frequency	VHF
300—3,000 MHz	Ultrahigh frequency	UHF

Continued on next page

Frequency

A *Hertzian wave* is an oscillating electromagnetic field. A continuous series of such waves of like characteristics is called a continuous wave (CW)—view A. Such a wave can be used in Morse code transmissions, the code being keyed so that the signal is interrupted when desired—view B. A continuous wave may be modified with some characteristics of an audio frequency signal, such as that produced by the human voice. When used in this way, it is called a *carrier wave*. The process of modifying the carrier wave in this manner is called *modulation.* After this has taken place, the carrier wave may be called a *modulated carrier* wave—view C. When this form of radio transmission is used, the transmitting station generates the carrier wave and modulates it by the message to be conveyed. The receiver demodulates the incoming signal by removing the modulating signal and converting it to its original form.



Nondirectional Radio Beacon

Introduction

The term *NDB* is a term that describes a class of homing facility.

Nondirectional radio beacon

Nondirectional indicates that these facilities provide a signal, used for homing, equally well in all directions. Homing essentially means that the pilot is keeping the nose of the aircraft pointed at the radio signal while proceeding toward the sending facility.

NDBs are intended for use with airborne direction-finding equipment to provide pilots with bearing information and as approach aids when installed in the vicinity of an airport.

Low- or medium-frequency radio beacons normally operate in the frequency band of 190 to 535 kHz and transmit a continuous three-letter identification except during voice transmission. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator. UHF NDBs operate in the frequency band of 275 to 287 MHz.

When the radio beacon is installed in conjunction with the ILS marker, it is normally called a Compass Locator and can be used for navigation at distances of approximately 15 miles or as authorized in an approach procedure.

Automatic direction finder

The *ADF* is an aircraft radio navigation system that senses and indicates the direction to an NDB ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft, depending on the type of indicator installed in the aircraft.

Limitations of NDBs

Radio beacons and receiving equipment are subject to atmospheric disturbances, which can make their use undesirable. The radio compass is subject to signal fade and static during stormy weather, which can result in erratic indicator operation. This can make NDBs unsuitable for homing approaches or for holding during thunderstorms. At night, other distant stations interfere with signal reception in the same way as standard radio receivers. Also, homing normally results in a curved course being flown, rather than a straight course, because of crosswinds acting on the aircraft.

VHF/UHF Omnidirectional Ranges

Introduction

Omni is from the Latin word *Omnis,* which means "all." An *omnifacility* provides an unlimited number of courses (called radials) in all directions. This is in contrast to the first nationwide system of airway beacons (four-course ranges) which provided guidance in only four directions.

Many different types of omnifacilities are in operation today—the VOR facility, the VOR/DME facility, the TACAN facility, and a facility that uses both VOR and TACAN called the VORTAC.

VHF omnidirectional range (VOR)

The VOR is a radio facility that eliminates many of the difficulties previously encountered in air navigation. VOR course information is not affected by weather or other factors common to ADF. With a course indicator, it is possible to select and precisely fly any one of 360 courses to or from a VOR.

VORs operate on frequencies between 108.0 and 117.95 MHz and are used by all types of aircraft for navigation and approach guidance. Courses produced by VOR facilities compare to the 360° points on a compass. These courses, known as radials, are identified by their magnetic bearing from the station. Regardless of heading, an aircraft on the 090° radial is physically located due east of the station. When an aircraft flies to the station on this radial, its magnetic course is 270°. Since the transmitting equipment is in the VHF band, the signals are free of atmospheric disturbances but are subject to line-of-sight reception. Reception range varies with the altitude of the aircraft. VORs are identified by their Morse code identification or by the recorded automatic voice identification which is always indicated by the use of the word "VOR" following the range's name. The accuracy of course alignment of the VOR is excellent, generally ±1°.

VOR/DME

Some VOR sites are equipped with a DME feature. The VOR/DME site furnishes azimuth information from the VOR and distance information from the DME facility. These are two separate types of equipment located at the same site. A pilot's access to azimuth and distance information from such a site is limited only by the aircraft's equipment.

Continued on next page

Tactical air navigation (TACAN) system

Although VOR was a great improvement over earlier navigational systems, a gap still existed in the information presented to the pilot. The TACAN system was developed to fill this gap by providing the pilot with the information needed for precise, geographical fixing of the aircraft position at all times.

TACAN added a continuous display of range information to the course information already available. An integral part of TACAN is DME, which provides continuous slant range distance information. Like VOR, TACAN provides 360 courses radiating from the station. Also, because the ground equipment is compact and relatively easy to transport, it provides greater versatility in installation and mobility than the VOR system.

TACAN operates in the UHF frequency band and has a total of 126 two-way channels. Air-to-ground frequencies (DME) for these channels are in the 1025 to 1150 MHz range, and associated ground-to-air frequencies are in the 962 to 1024 MHz and 1151 to 1213 MHz ranges. Channels are spaced at 1-MHz intervals in these ranges. The TACAN identifies itself aurally through Morse code every 35 seconds.

TACAN ground equipment has either a fixed or mobile transmitting unit capable of providing bearing information to an unlimited number of aircraft, but is limited to 120 simultaneous replies for distance information. The airborne unit (interrogator), in conjunction with the ground unit (transponder), reduces the transmitted signal to a visual presentation of both azimuth and distance information.

TACAN facilities are usually dual-transmitter equipped (one operating and one in standby), fully monitored installations which automatically switch to the standby transmitter when a malfunction occurs. The monitor is located in the control tower or radar room and provides a warning when an out-of-tolerance condition exists.

The TACAN system readily lends itself to unique military and naval requirements and the FAA has integrated TACAN facilities with the civil VOR/DME program. Although the theoretical or technical principles of operation of TACAN are quite different from those of the VOR facilities, the end result is the same.

Continued on next page

VHF/UHF Omnidirectional Ranges, Continued

VORTAC

Integrated VOR and TACAN facilities are called VORTACs. A VORTAC provides the following services:

- VOR azimuth
- TACAN azimuth
- TACAN distance (DME)

The VOR and TACAN of a VORTAC system are each identified by a three-letter code transmission. In addition, the VOR and TACAN are assigned paired frequency channels so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are from the same ground station.

Distance Measuring Equipment

Introduction

The distance from a known ground point is essential information necessary to accuracy in navigation.

DME

The availability of DME to a pilot depends on whether there is DME associated with the facility being used and whether the equipment needed is on board the aircraft. The two parts to every DME system are the ground station, called the transponder, and the airborne portion, called the interrogator. Inquiries are sent from the interrogator to the transponder, which replies with data that the interrogator can process and display to the pilot as distance from the transponder site. DME operates on the line-of-sight principle and furnishes information with a high degree of accuracy. Reliable signals may be received at distances up to 199 nm at line-of-sight altitude with an accuracy of better than 1/2 mile or 3 percent of the distance, whichever is greater.

DME operates on frequencies in the UHF band between 962 to 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have separate DME equipment.

DME can also be associated with an ILS. The ILS provides the pilot with distance information from the touchdown point on the runway. In such an arrangement, the DME transponder is located at the ILS glide slope site.

Omniranges, General

Introduction

You have probably seen several reasons why omniranges are preferable to NDBs. Three reasons quickly come to mind:

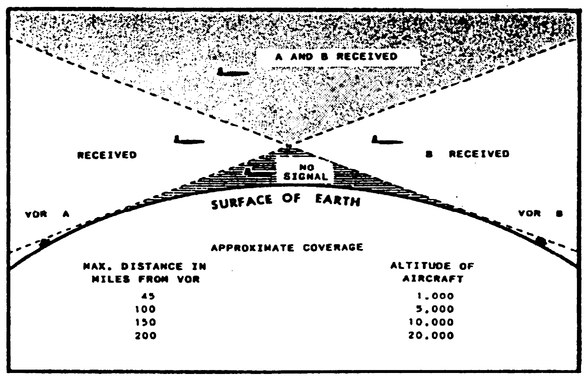
- they provide straight courses,
- they are not subject to atmospheric disturbances, and
- more accurate fixing is obtainable.

Through the use of DME, reduced separation standards are possible and holding patterns are tightened up, allowing more air traffic to be compressed into less airspace. It is now routine for a pilot to maneuver from one radial/DME fix to another.

The following general information on omniranges will help you become a better controller through the understanding of the use and limitations of the equipment at hand.

Reception distance

Like all VHF/UHF transmissions, omnirange signals follow a line-of-sight course, which causes an increase in reception distance as the altitude of an aircraft increases. To ensure reception at minimum en route altitude (1,000 feet above terrain), omniranges are spaced sufficiently close together to assure navigation coverage over the airway system.



Classification

VOR, VORTAC, and TACAN NAVAIDs are classified according to their operational use: (1) terminal—*T,* (2) low altitude—*L,* or (3) high altitude—*H.* The use of the facilities beyond the prescribed limitations may result in unreliable indications in the aircraft. You should refer to *Flight Services,* FAA 7110.10, and the *AIM* for specific altitude and distance limitations and associated clearance limitations.

Continued on next page

VOR receiver checks

The FAA VOR test facility (VOT) transmits a test signal that provides users a convenient means to determine the operational status and accuracy of a VOR receiver while on the ground where a VOT is located. Airborne use is permitted. Its use is strictly limited, however, to those areas and altitudes specifically authorized in the *Airport/Facility Directory* or appropriate supplement.

Besides the VOT, naval air stations have checkpoints on a taxiway or ramp area marked to indicate the distance and bearing to the TACAN/VOR.

Instrument Landing System

Introduction

The most precise en route navigation system is of little value unless an approach and landing can be successfully completed at the aircraft's destination. Since the early days of instrument flight, approach procedures have been developed and used with a high degree of safety. The ILS provides an approach path for exact alignment and descent of an aircraft on final approach to a runway.

ILS

The ILS ground equipment has two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and the glide slope transmitter. The system may be divided functionally into three parts:

Information Provided	Equipment
Guidance	Localizer, glide slope
Range	Marker beacon, DME
Visual	Approach lights, touchdown and centerline lights, runway lights

Each ILS is categorically classified according to the performance capability of the ground equipment. A Category I ILS is capable of providing acceptable guidance information down to a decision height (the point where a missed approach is made if the pilot cannot complete the approach visually) of not less than 200 feet. A Category II ILS is capable of providing acceptable guidance down to a decision height of not less than 100 feet. A Category III ILS is capable of providing acceptable guidance information without decision-height minima.

Localizer transmitter

The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Identification is in Morse code and consists of a three-letter identifier preceded by the letter "I". The signal provides the pilot with course guidance to the runway centerline. The localizer antenna is sited at the far end of the runway so that the center of the antenna is in line with the centerline of the runway. The localizer provides

Continued on next page

Localizer transmitter (continued)

course guidance throughout the descent path to the runway threshold for a distance of 18 nm from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. The course line along the extended centerline in the opposite direction to the front course is called the back course.

Glide slope transmitter

The glide slope transmitter operates on one of 40 ILS channels within the frequency range of 329.15 to 335.00 MHz. The glide slope transmitter is located between 750 and 1,250 feet from the approach end of the runway and is offset 250 to 650 feet from the runway centerline. The glide path feature of the ILS is what makes it a precision approach. The principle of operation is similar to that of the localizer, however, the glide path transmitter provides precision descent information along the final approach course at the desired degree of glide slope. The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to a distance of 10 nm. Since the glide path signal is sent out the front course only, the back course is not a precision approach and will have higher minimums.

Marker beacons

ILS marker beacons have a rated power output of 3 watts or less and are located along the ILS approach course. Ordinarily, there are two marker beacons associated with an ILS: the OM, and the MM. Airports with a Category II or Category III ILS will also have an IM.

The OM normally indicates a position where an aircraft at the proper altitude will intercept the glide path on the localizer course. The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone. The IM will indicate a point where an aircraft is at a designated DH on a glide path between the MM and landing threshold.

Continued on next page

Compass locator

A radio beacon used in conjunction with ILS markers is called a compass locator. This beacon transmits nondirectional signals that are used by pilots to determine bearings.

The range of a compass locator transmitter is at least 15 miles and is often located at the ILS MM and OM sites. Compass locators transmit two-letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

Monitoring Navigation Aids

Introduction

The most refined of the NAVAIDs is of little value when it is not working. Only when these NAVAIDs are on the air and functioning properly can you and the pilot make use of their data. It is essential that you know the status of NAVAID equipment at all times.

Remote monitoring

Each facility that is delegated monitoring responsibility is required to continuously monitor a NAVAID that is required or desired to remain on the air. This authority may be delegated to any on-station agency provided that (1) continuous manning is maintained; (2) automatic visual and aural alarms are installed; (3) maintenance personnel are readily available in the event of a malfunction; and (4) NOTAM responsibilities can be met.

When these conditions can't be met, the periods of operation must be published in the appropriate FLIP products, and the NAVAID must be monitored during those periods. Whenever the NAVAID can't be monitored, it must be put in a nonradiating status or the identification feature must be removed.

Site monitoring

During flight operations, a NAVAID's operational status must be continuously monitored. Sometimes the equipment used to monitor the NAVAID's status is located at a site different from its actual location (i.e., in a radar room or control tower cab). When the NAVAID's monitor equipment at a remote site malfunctions and the NAVAID can't be monitored from the remote site, personnel must be sent to the NAVAID's actual site. These personnel monitor the NAVAID's status until the conclusion of flight operations.

When a NAVAID is monitored at the site, you must ensure that the monitoring equipment is operating properly and that reliable two-way communications are available between the site and the primary facility.

CHAPTER 3

MILITARY AIRCRAFT IDENTIFICATION, PERFORMANCE, AND CHARACTERISTICS

Overview

Introduction

As an air traffic controller, it is essential that you have an understanding of aircraft mission, performance, and operating characteristics. This doesn't mean that you have to be a pilot or have a degree in aeronautical engineering, but a basic understanding will enable you to assist the pilot and possibly prevent you from issuing control instructions that the pilot cannot perform. This information is also an integral part of your planning and execution of control procedures. In this chapter, we will discuss the military aircraft that you will most likely come in contact with as a Navy Air Traffic Controller.

Objectives

The material in this chapter will enable the student to:

- Identify aircraft by their designations.
- Recognize aircraft performance and maneuverability capabilities.
- Recognize aircraft operational characteristics.

Acronyms

The following list contains acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
ATC	Air traffic control
fpm	feet per minute
ft	feet

Continued on next gage

Acronyms (continued)

Table continued from page 3-1.

in.	inches
kn	knots
MEDEVAC	Medical evacuation
mph	miles per hour
SAR	Search and rescue
VOD	Vertical onboard delivery

Topics

This chapter is divided into three sections:

Section A
Aircraft Designation

Overview

Introduction

All aircraft of the Armed Forces have tri-service designations; that is, a given aircraft bears the same alphanumeric identification symbol whether it is used by the Navy, Army, or Air Force. The designation system uses a sequence of letters and numbers to identify aircraft by special status, mission modification, basic mission, and design modification.

In this section

This section covers the following topics:

Basic Mission

Introduction

As stated in the overview, all military aircraft have a tri-service alphanumeric identification symbol. One portion of this identification symbol is the basic mission identifier.

Basic mission identifiers

The basic military designator of an aircraft contains a minimum of a letter and a number with the letter (basic mission identifier) always being first in the sequence (i.e., **C**-130, **F**-14, **S**-3). The letter indicates the basic mission of the aircraft. The table below lists the basic mission letters used by the Armed Forces and the corresponding mission.

Basic Mission			
A	Attack	P	Patrol
B	Bomber	R	Reconnaissance
C	Cargo/transport	S	Antisubmarine
E	Special electronic installation	T	Trainer
F	Fighter	U	Utility
H	Helicopter	V	VTOL and STOL
K	Tanker	X	Research
O	Observation		

Mission Modification

Introduction

A mission modification symbol is used in conjunction with the basic mission identifier to indicate that the basic mission of the aircraft has been changed or modified.

Mission modification symbol

When an aircraft is modified from its original mission, a mission modification letter precedes the basic mission letter. For example:

- **E**A-6
- **K**C-130

In the above example, the E represents a special electronic installation on an A-6 and the K indicates an C-130 that is capable of tanking other aircraft. The following table lists the mission modification symbols and their meanings.

Mission Modification Symbols

A	Attack	Q	Drone
C	Cargo	R	Reconnaissance
D	Director (for controlling drone aircraft or missiles)	S	Antisubmarine
E	Special electronic installations	T	Trainer
H	Search and rescue	U	Utility
K	Tanker	V	Staff
L	Cold weather plane (arctic or antarctic operations)	W	Weather
M	Missile carrier		

Special Status

Special status identifiers

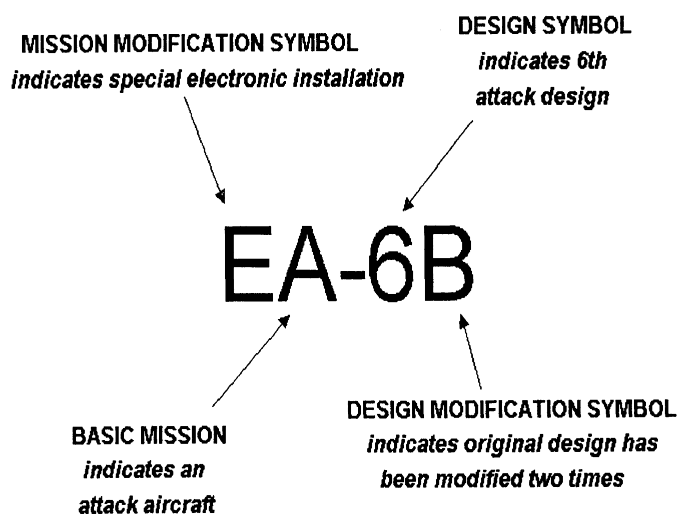
Occasionally, a letter will prefix the basic mission identifier or mission modification symbol. This letter prefix is called a special status identifier and indicates the special use of an aircraft. The special status identifiers are listed in the table below.

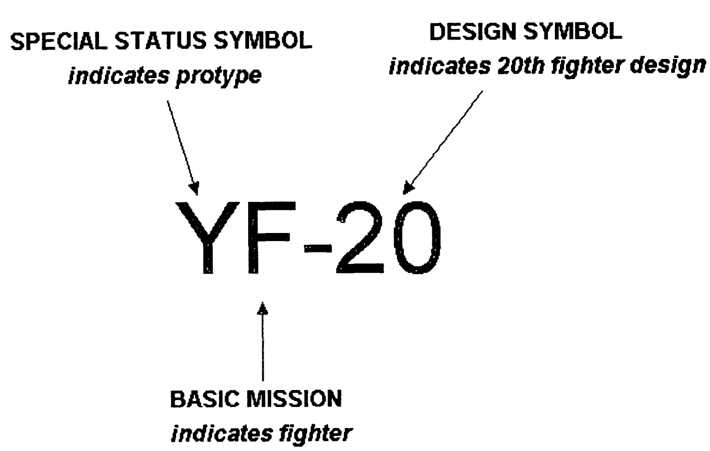
Special Status	
G	Permanently grounded (for instruction and ground training purposes)
J	Special test, temporary (modified for special testing; upon completion of tests, plane will be restored to its original design)
N	Special test, permanent (permanently modified for testing)
X	Experimental (not yet adopted for service use)
Y	Prototype (purchases in limited numbers for complete testing of design)
Z	Planning (indicates aircraft is in early stages of planning or development)

Design and Design Modifications

Design and design modification symbols

The number following the basic mission symbol indicates the design number of the type of aircraft. The designator F-14 shows an aircraft to be the 14th fighter design. If a particular design is modified, the design number is followed by another letter (A, B, C . . .), the alphabetical order of which identifies the number of the modification. For example, the C in E-2C tells us that the original design of this aircraft has been modified three times. The following figures show examples of how aircraft designations are used.





Section B
General Aircraft Performance and Characteristics

Overview

Introduction

To provide service to aircraft under your control, you must know something of their characteristics and limitations. This knowledge enables you to appreciate some of the problems that confront the pilot. It also gives you confidence in your ability and makes it easier for you to plan ahead.

Often you control several aircraft at once, and it is your responsibility to provide separation between them. A knowledge of the speed, rate of climb and descent, rate of turn, and maneuverability of different aircraft is vitally important.

In this section

This section will cover the following topics:

Field Elevation, Temperature, and Humidity

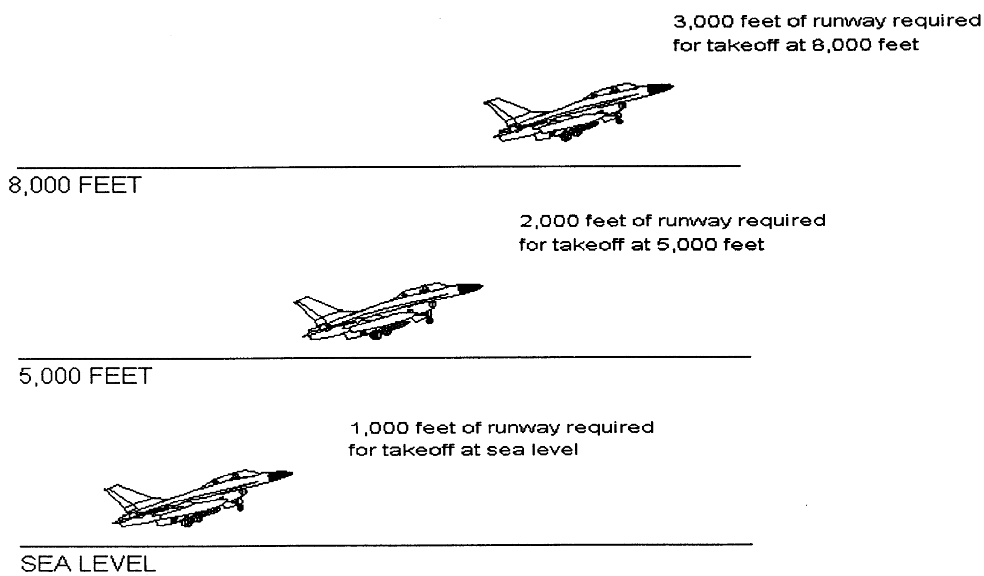
Introduction

The performance and maneuverability of different aircraft vary since each type of aircraft has its own set of characteristics governing its performance in the air or on the ground. This performance is affected by field elevation and temperature.

Effects of field elevation, temperature, and humidity

Field elevations and runway temperatures are vital elements in the control of jet aircraft. An example of the effect that altitude has on even a light aircraft is when an aircraft that has a rate of climb of 420 fpm at sea level has its rate of climb reduced to 225 fpm at 5,000 feet. The distance needed for takeoff is doubled between these two altitudes.

High temperatures and high humidity have similar effects on aircraft performance. A high-performance jet fighter quite possibly may not operate from an airfield with short runways on a day on which high runway temperatures prevail, even though the field elevation is only moderately high. Later in the afternoon or at night, the same fighter may be able to effect a takeoff from the same field because the atmosphere cools and becomes more dense during night hours. More lift is afforded an aircraft in dense air, regardless of aircraft type.



Comparison of takeoff distances with increased altitudes

Aircraft Speeds

Introduction

One great concern in air traffic control is aircraft speed. While speeds of conventional-type aircraft vary, speed differences between conventional and jet aircraft are even greater. You need to be aware of these differences and take them into consideration.

Traffic pattern speeds

Traffic pattern speeds are of primary interest since most of your duties are in terminal control facilities. A very important portion of the traffic pattern is the final approach course. That is where most accidents or incidents occur. They usually are the result of an incorrect sequencing technique, failure to issue timely information, or failure to consider approach speeds when a landing sequence is issued.

The following example was an actual incident:

> A T-2C was "cleared touch-and-go number one" by the tower. The T-2C was executing a normal approach at approximately 93 knots. An instructor pilot in the rear seat of a TA-4J was demonstrating an abeam approach procedure. The TA-4J was "cleared touch-and-go number two" by the tower. The instructor of the TA-4J heard his or her clearance for touch-and-go but failed to understand that he or she was number two on approach. With both aircraft on final approach, the TA-4J passed directly over the T-2C at about 25 feet. Both aircraft touched down on the runway, the TA-4J in front of the T-2C, and both lifted off again after their touch-and-go landings. The TA-4J never saw the T-2C.

The two aircraft had dissimilar airspeeds (the TA-4J being much faster) and pattern descent rates. Without getting into all of the rights and wrongs of the case, let's just take it for the lesson it teaches: due consideration must be given to approach speeds and other operational characteristics when landing sequences are assigned.

Aircraft Climb and Descent Rates

Introduction

Air Traffic Controllers often need to direct pilots to make altitude changes to maintain proper separation between flights. Therefore, you should have some idea of what performance rates are within the capability of certain aircraft.

Climb and descent rates

Conventional-type aircraft climb/descent rates vary from 500 fpm to 2,000 fpm, whereas jets climb/descent rates vary from 3,000 fpm to 5,000 fpm. These rates reflect normal operating ranges, and should not be confused with maximum performance rates. Air traffic control related factors, such as weather, type of flight, and fuel status, must also be considered when you are anticipating separation based on the normal climb or descent characteristics of aircraft.

Consider a departure controller directing a departing aircraft to a fix where existing conditions require that the aircraft be at a specified altitude before reaching this fix. If the flight were an air evacuation flight with patients aboard, its rate of climb would certainly be lessened. The controller should recognize this fact. Instead of "driving" the aircraft straight to the fix, the controller should determine, by asking the pilot, if he or she can reach the altitude, and should be responsive to any request for more climbing time.

It is imperative that you apply good control techniques and judgement and be aware of the operating parameters of the different aircraft that you are responsible for.

Fuel Consumption

Introduction

An important characteristic of jets is their high rate of fuel consumption, especially at low altitudes and while operating on the ground.

Jet fuel consumption

Ideally, jets should be off the ground as soon as possible after engine startup, especially fighters. Fighter jets normally have a short-range capability, which, when coupled with an air traffic control delay, could hamper their missions.

The fuel consumption rate of jets varies, but the following rule of thumb is suggested as a guideline: a typical jet fighter uses fuel at approximately 100 pounds per minute (133.5 pounds equals 20 gallons). Fighter pilots prefer to remain at high altitudes as long as possible, since the fuel consumption rate is greater at low altitudes and fighters often have little fuel left on arrival at their destination. As a controller, you must anticipate such action and plan your activities to prevent undue delays in handling jet traffic.

Also, local directives may give jets priority over conventional aircraft except in emergencies. Therefore, your job is to adhere to established base traffic priority procedures as closely as possible, and to help a jet conserve fuel by not unduly delaying its operation. If delay is unavoidable, promptly advise the pilot of the situation.

Minimum fuel

Occasionally, you may hear a pilot declare "minimum fuel." "Minimum fuel" indicates that the aircraft's fuel supply has reached the state where the pilot can accept little or no delay upon reaching the destination. It is not necessary that you discontinue other approaches or landings and give "minimum fuel" aircraft priority, but you should give "minimum fuel" aircraft preference if you have or anticipate a traffic conflict. Always relay "minimum fuel" information to the controller to whom control jurisdiction is transferred, if applicable.

Do not confuse a "minimum fuel" report with a "low or emergency fuel" report. A "low or emergency fuel" report is an emergency and should be given priority. When the remaining usable fuel supply is so low that traffic priority is needed to ensure the aircraft's safe landing, the pilot should declare an emergency with ATC and should report, in minutes, the amount of fuel remaining. Always relay "low or emergency fuel" information to the controller to whom control jurisdiction is transferred, if applicable.

Section C
Selected Navy Aircraft

Overview

Introduction

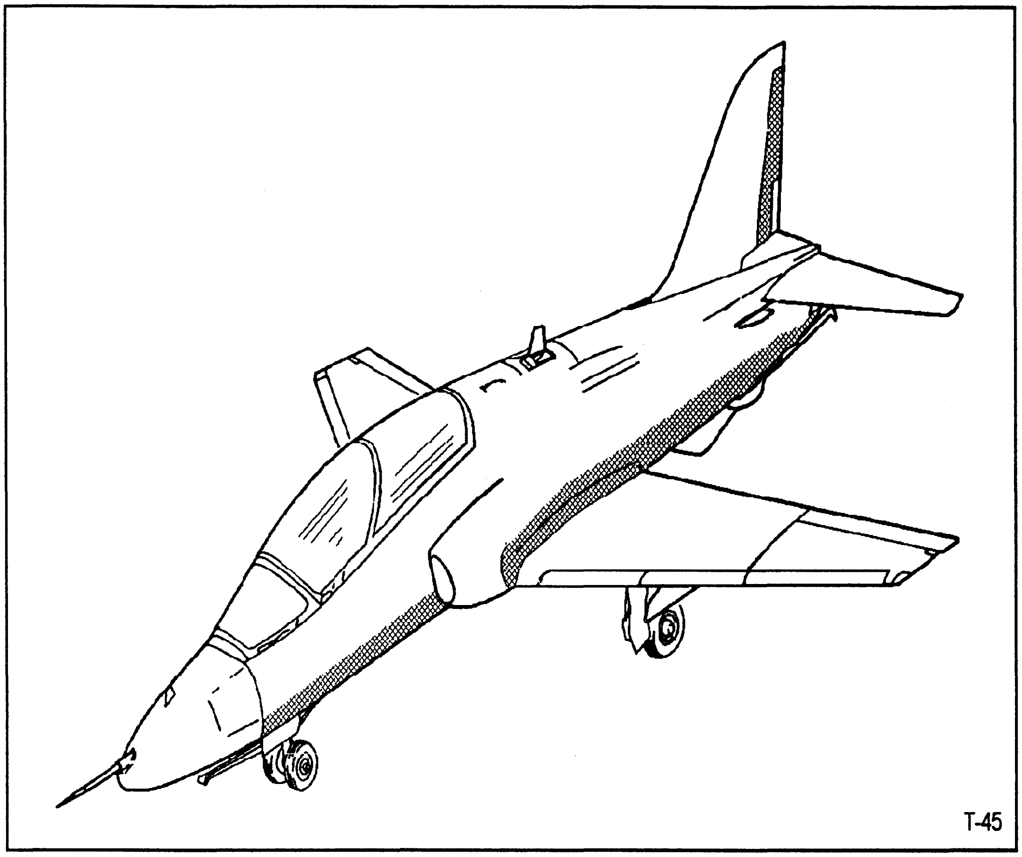
The remainder of this chapter deals with Navy aircraft. The list contains the majority of the aircraft you will come in contact with, however, it is not all inclusive. This brief overview should help to familiarize you with many of the aircraft with which you will be working. Keep in mind that memorizing exact figures is not important, but they are used in this text to show the type of comparison that you will make when issuing instructions.

The measurements below are rounded to the nearest inch, and the listed approach speeds are "average" and can vary.

In this section

This section will cover the following topics:

T-45
Goshawk

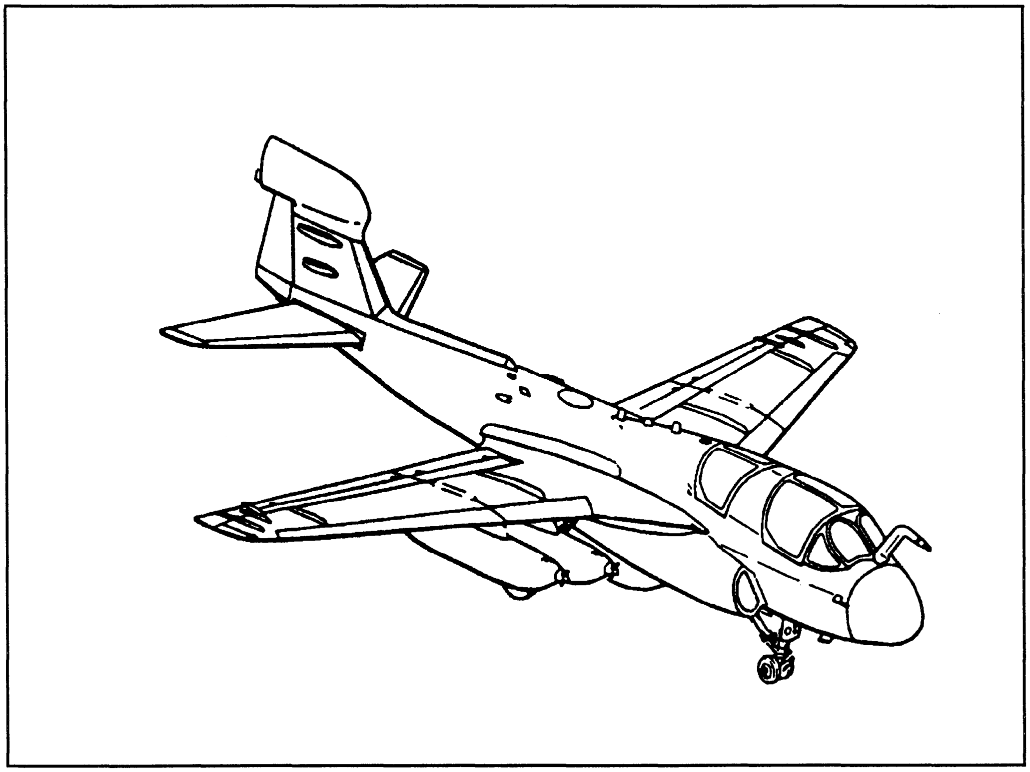


T-45

T-45 *Goshawk*			
Wing span	30 ft 9 in.	Length	39 ft 4 in.
Height	13 ft 4 in.	Approach speed	144 mph
Category	III	Ceiling	40,000 ft
Remarks	Manufactured by McDonnell Douglas/British Aerospace. Primary mission is to provide intermediate and advanced strike fighter training. Is aircraft carrier capable. Is replacing the TA-4 and the T-2.		

EA-6B Prowler

EA-6B *Prowler*

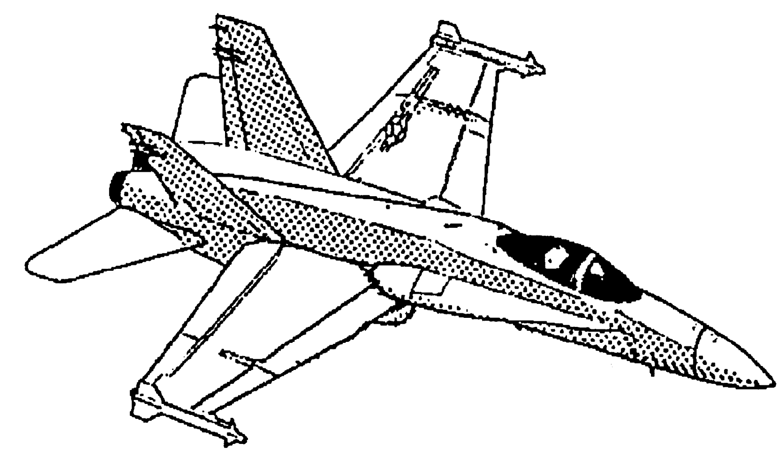


EA-6B

EA-6B *Prowler*			
Wing span	53 ft	Length	59 ft 10 in.
Height	16 ft 3 in.	Climb rate	8,600 fpm
Ceiling	41,400 ft	Descent rate	3,000 fpm
Category	III	Approach speed	126 kn
Remarks	Manufactured by Grumman Corporation. Carrier- and land-based, twin-engine, mid-wing aircraft. Primary Navy mission is electronic warfare (jamming)/special electronics.		

F/A-18 *Hornet*

F/A-18 *Hornet*



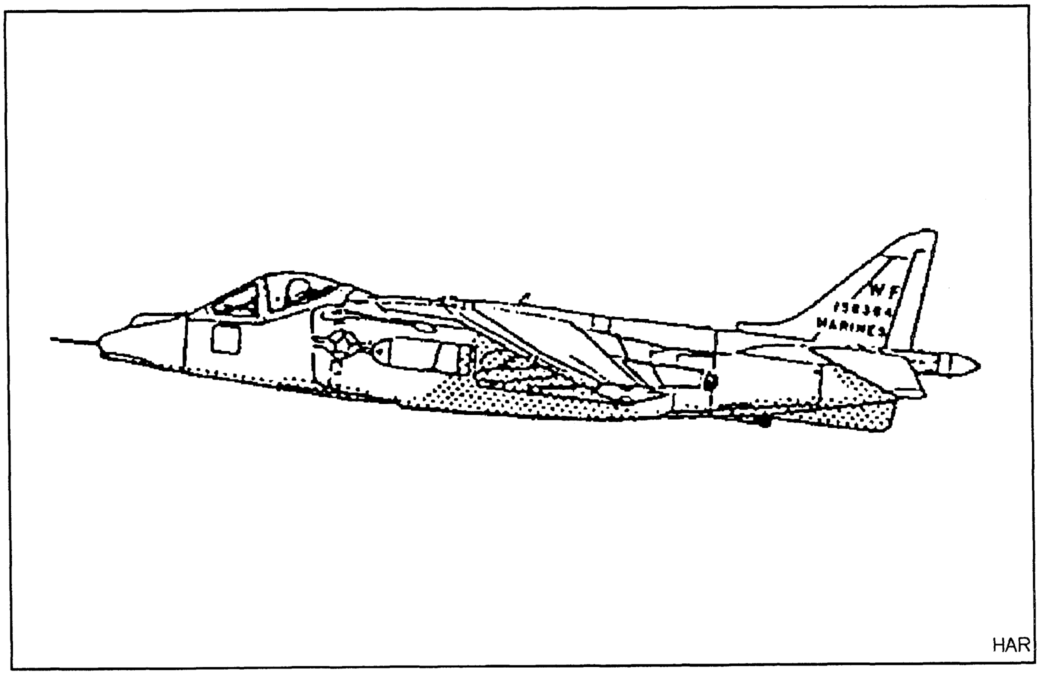
F/A-18

F/A-18

F/A-18 *Hornet*			
Wing span	37 ft 6 in.	Length	56 ft 0 in.
Height	15 ft 3 in.	Climb rate	8,000 fpm
Approach speed	141 kn	Descent rate	6,000 fpm
Category	III	Ceiling	50,000 ft.
Remarks	Manufactured by McDonnell Douglas Corporation. Carrier- and land-based, twin-engine strike fighter aircraft. Afterburner equipped. The F/A-18A, C, and E are single seat. The F/A-18B, D, and F are two seat. The F/A-18E and F are based on a lengthened and upgraded design.		

HAR *Harrier*

HAR
Harrier

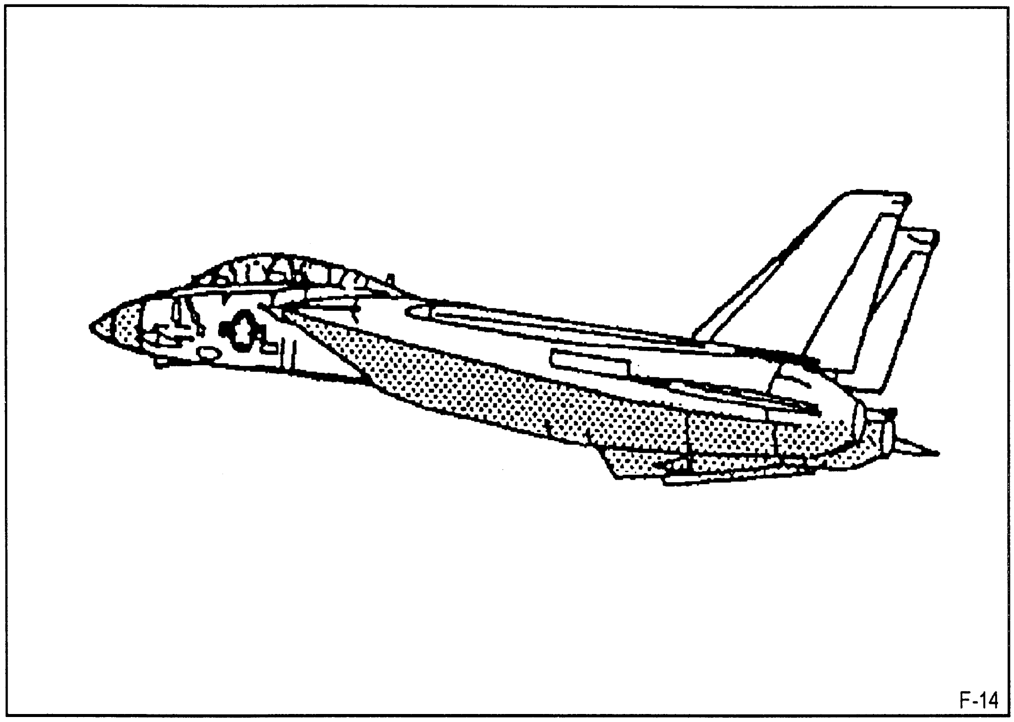


HAR

HAR *Harrier*			
Wing span	30 ft 4 in.	Length	46 ft 4 in.
Height	11 ft 7 in.	Category	III
Climb rate	5,000 fpm	Descent rate	8,000 fpm
Remarks	Manufactured by British Aerospace. The HAR is used by the Marine Corps as a vertical/short takeoff and landing (V/STOL) aircraft. Its mission is close support, battlefield interdiction, night attack, and reconnaissance. It is capable of operating from unprepared fields and amphibious assault ships (LHA/LHD).		

F-14 *Tomcat*

F-14 ***Tomcat***

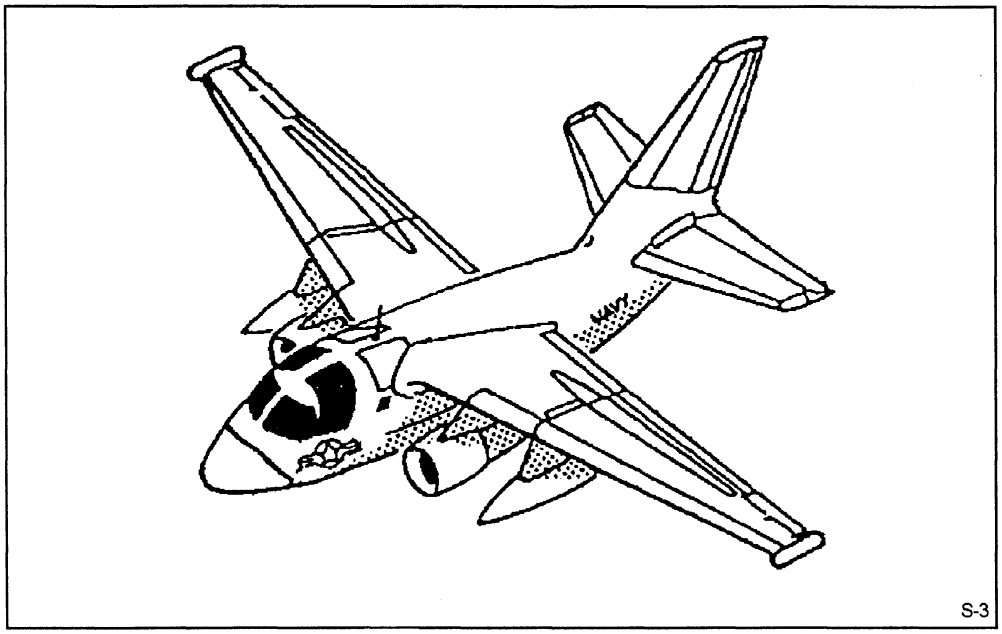


F-14

F-14 ***Tomcat***			
Wing span	64 ft 1 in.	Length	62 ft 8 in.
Height	16 ft 0 in.	Climb rate	6,000 fpm
Ceiling	53,000 ft	Descent rate	4,000 fpm
Category	III	Approach speed	135 kn
Remarks	Manufactured by the Grumman Corporation. Sweep wing design, carrier-based, air superiority fighter, long-range interceptor with attack capability. A two-seat, twin-engine aircraft, it has wings that sweep back for high-speed flight. Afterburner equipped.		

S-3 *Viking*

S-3 *Viking*

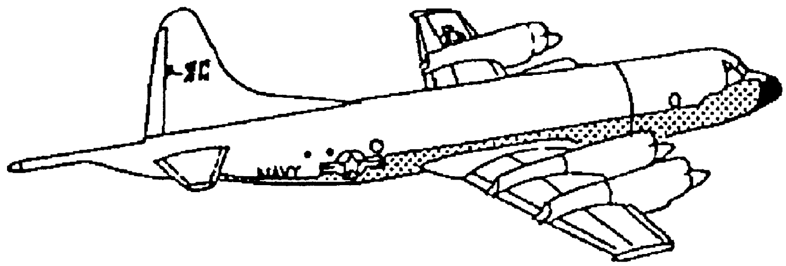


S-3

S-3 *Viking*			
Wing span	68 ft 8 in.	Length	53 ft 4 in.
Height	22 ft 9 in.	Climb rate	2,000 fpm
Ceiling	35,000 ft	Descent rate	2,000 fpm
Approach speed	116 kn	Category	III
Remarks	Manufactured by the Lockheed Corporation. Four-seat, twin turbofan jet, all-weather, carrier-based undersea warfare aircraft. Variants perform the tanker (KS-3) and electronic intelligence (ES-3) missions.		

P-3 *Orion*

P-3 *Orion*

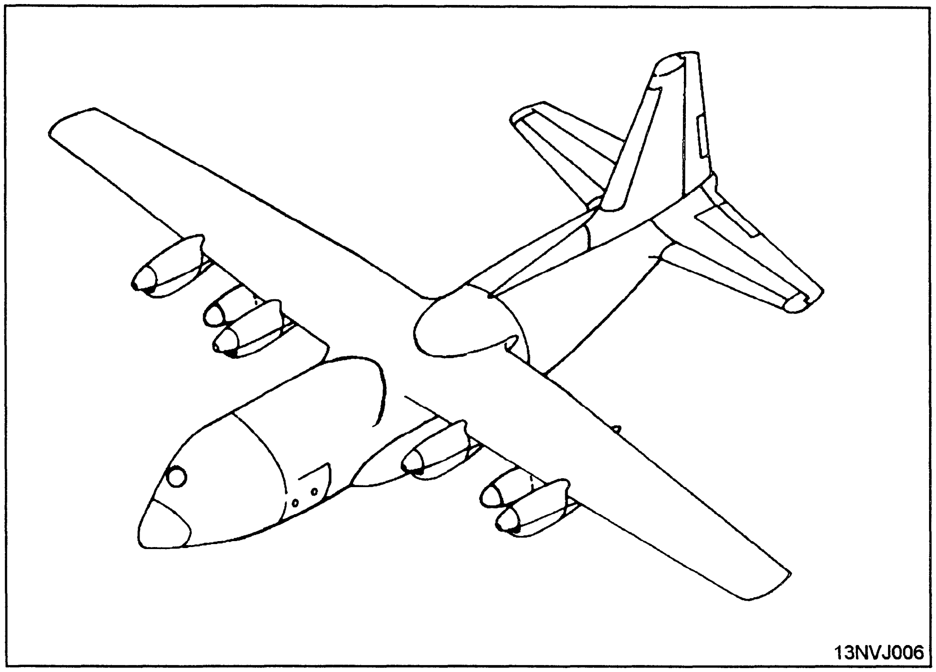


P-3

P-3 *Orion*			
Wing span	99 ft 8 in.	Length	116 ft 10 in.
Height	33 ft 8 in.	Climb rate	1,850 fpm
Approach speed	140 knots	Descent rate	2,000 fpm
Category	III	Ceiling	28,300 ft
Remarks	Manufactured by Lockheed Corporation. Primary mission is land-based maritime patrol and undersea warfare. The aircraft can operate for over 17 hours on two engines. Reversible pitch propellers allow the aircraft to land in a relatively short distance (less than 3,000 ft).		

C-130 *Hercules*

C-130 Hercules

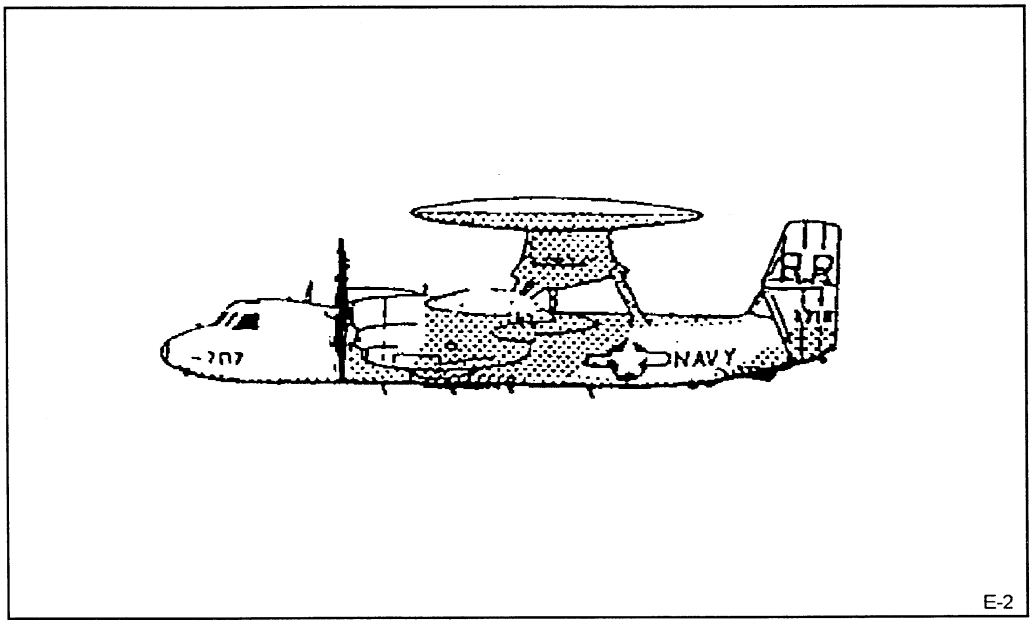


C-130

C-130 *Hercules*			
Wing span	132 ft 7 in.	Length	97 ft 9 in.
Height	38 ft 3 in.	Climb rate	1,500 fpm
Approach speed	140 mph	Descent rate	1,500 fpm
Category	III	Ceiling	33,000 ft
Remarks	Manufactured by the Lockheed Corporation. The C-130 is a multimission and tactical transport aircraft with four engines and a high wing. A rear ramp provides access to the cargo compartment and can be opened in flight for parachuting troops or equipment. Reversible pitch propellers allow for very short landing distance.		

E-2 *Hawkeye*

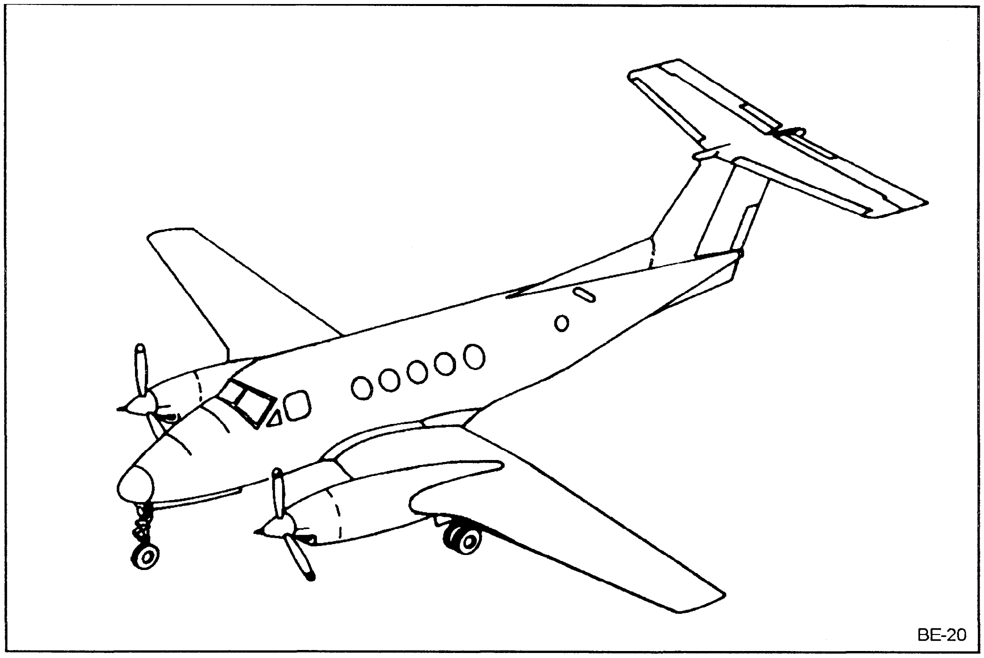
E-2 *Hawkeye*



E-2

E-2 *Hawkeye*			
Wing span	80 ft 7 in.	Length	57 ft 6 in.
Height	18 ft 3 in.	Climb rate	2,690 fpm
Approach speed	115 kn (E-2C)	Descent rate	3,000 fpm
Category	III	Ceiling	37,000 ft
Remarks	Manufactured by the Grumman Corporation. The aircraft mission is to serve as an airborne early warning platform and as an airborne platform from which to control aircraft. This carrier-based aircraft is capable of tracking more than 2,000 targets simultaneously and running more than 40 intercepts. The radome above the rear fuselage measures 24 feet in diameter.		

BE-20 ***Super King Air***

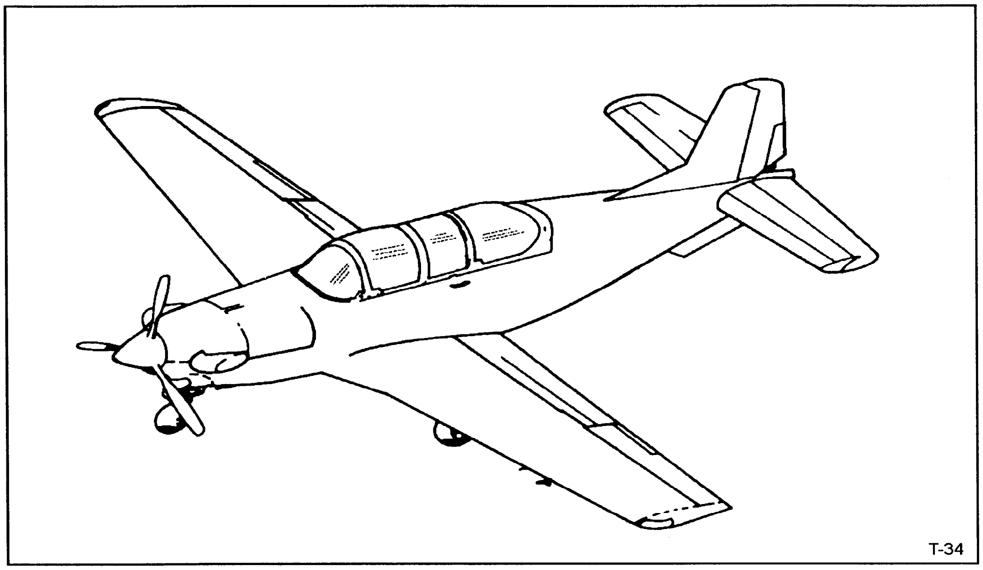


BE-20

BE-20 ***Super King Air***			
Wing span	54 ft 6 in.	Length	43 ft 9 in.
Height	15 ft 0 in.	Climb rate	2,450 fpm
Ceiling	35,000 ft	Descent rate	2,500 fpm
Category	II		
Remarks	Manufactured by the Beech Aircraft Corporation. Primary Navy mission is passenger/cargo transport. Twin turboprop engines mounted far forward on the low wing. T-tail configuration.		

T-34 *Mentor*

T-34 ***Mentor***

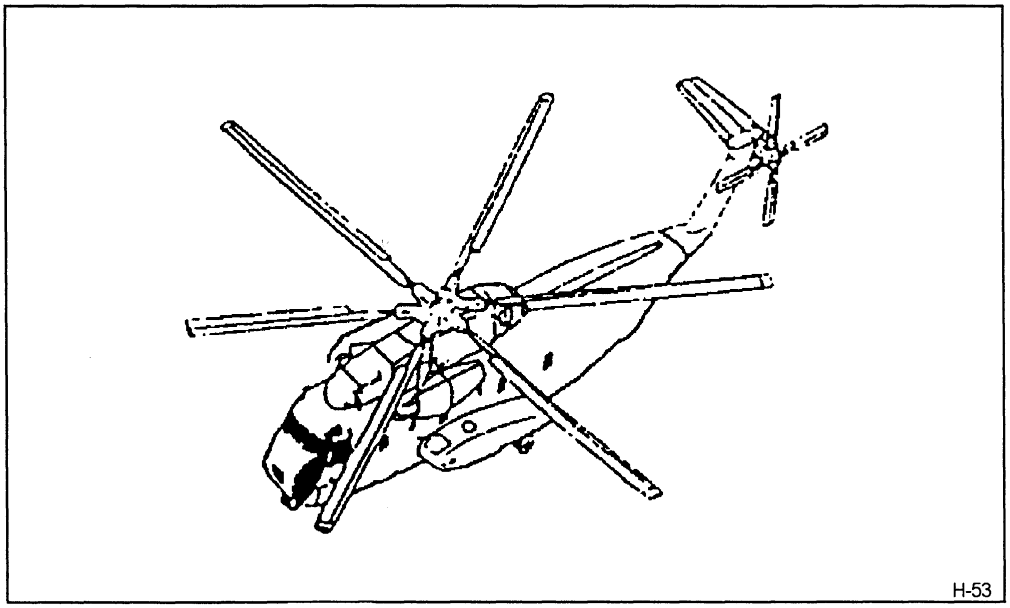


T-34

T-34 ***Mentor***			
Wing span	33 ft 3 in.	Length	28 ft 8 in.
Height	9 ft 7 in.	Climb rate	1,150 fpm
Approach speed	120 mph	Descent rate	1,150 fpm
Category	I	Ceiling	35,000 ft
Remarks	Manufactured by Beech Aircraft Corporation. Two-seat turboprop used for primary flight training, recruiting, and target spotting for strike fighter aircraft. Not carrier capable.		

H-53 *Super Stallion/Sea Dragon*

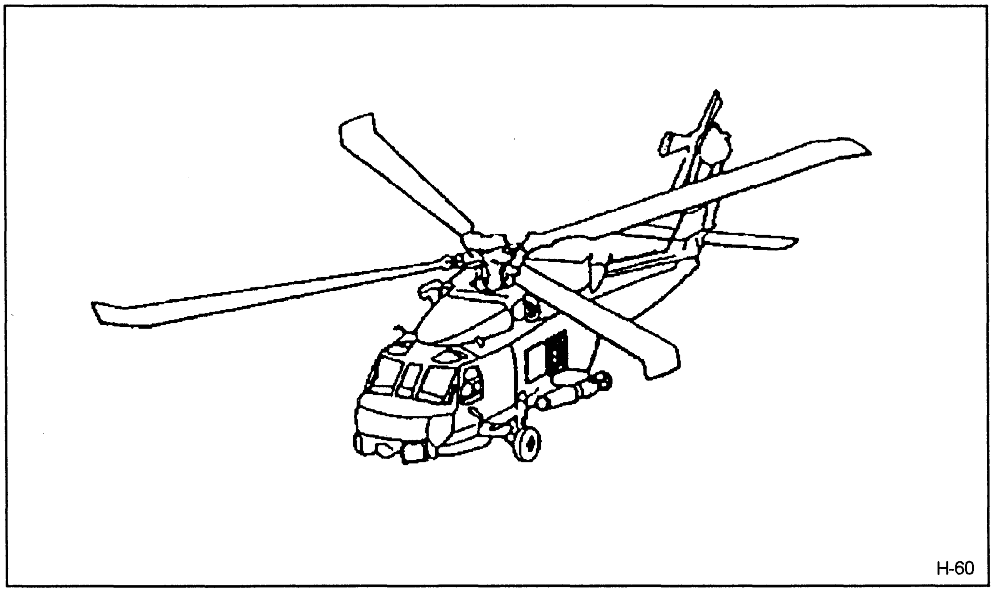
H-53 ***Super Stallion/Sea Dragon***



H-53

H-53 ***Super Stallion Sea Dragon***			
Fuselage width	8 ft 10 in.	Length	73 ft 4 in.
Height	17 ft 5 in.	Max speed	196 mph
Climb rate	1,500 fpm	Descent rate	1,500 fpm
Category	I	Ceiling	18,500 ft
Remarks	Manufactured by Sikorsky Aircraft. Navy uses the CH-53E *Super Stallion* for VOD and recovery of damaged aircraft from aircraft carriers and the MH-53E *Sea Dragon* for mine countermeasures. Marine Corps uses the CH-53E for amphibious assault, heavy equipment and armament transport, and disabled aircraft recovery. Over 1,200-mile maximum range. Generates significant wake turbulence and rotor wash.		

H-60 *Seahawk*

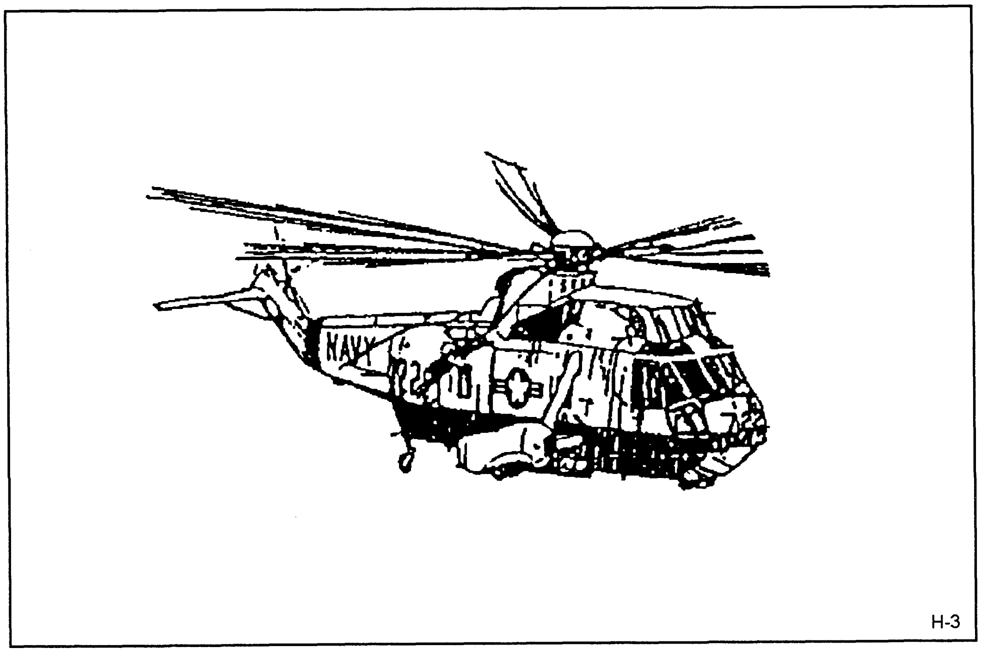


H-60

H-60 ***Seahawk***			
Width	10 ft 8 in.	Length	40 ft 11 in.
Height	12 ft 5 in.	Max speed	169 mph
Climb rate	2,000 fpm	Descent rate	2,000 fpm
Category	I		
Remarks	Manufactured by Sikorsky Aircraft. Primary mission is undersea warfare and antiship surveillance and targeting. Also provides SAR, MEDEVAC, planeguard, and VOD. Landing gear is non-retractable. SH-60B is embarked on cruisers, destroyers, and frigates in two-plane detachments from HSL squadrons. SH-60F is combined with two HH-60Hs in six-plane HS squadrons aboard aircraft carriers. Range is 150 nm with 1-hour loiter.		

H-3 *Sea King*

H-3 ***Sea King***



H-3

H-3 ***Sea King***			
Main rotor diameter	62 ft 0 in.	Length	72 ft 8 in.
Height	15 ft 6 in.	Max speed	166 mph
Climb rate	1,500 fpm	Descent rate	1,500 fpm
Ceiling	14,700 ft	Category	I
Remarks	Manufactured by Sikorsky Aircraft. Previously the Navy's standard carrier-based undersea warfare helicopter. Replaced by SH-60. Now flown only in the utility and VIP roles. Maximum range at optimum conditions is 625 miles.		

Remotely Operated Aircraft

Introduction

As a Navy air traffic controller, you may be assigned to an ATC facility that deals with remotely operated aircraft (ROAs). Specific operating procedures such as submission of flight schedules, weather minimums, course rules, and applicable air traffic control procedures should be outlined in local *Air Operations Manuals* or facility directives. Also, these type of aircraft have different designations such as remotely operated aircraft (ROAs), unmanned air vehicle (UAV), and so forth.

Control station

Two-way radio communications must be established between the ROA control station and the appropriate ATC facility before takeoff and during the duration of the aircraft flight.

ROA operating areas

Because ROAs are remotely controlled, specific areas (i.e., exclusive use restricted areas) are normally established for their test flights. These aircraft fly profiles designed to meet particular test criteria. Flight outside these profiles is normally restricted to:

- transitioning to or from the profile,
- entry into the landing pattern, or
- proceeding to a pre-designated ditching area under emergency conditions.

Equipment requirements

ROAs have extended range capability but are limited in their ability to "see and avoid" other traffic. Therefore, certain equipment requirements are normally established for ROA operations such as:

- Fully operational primary and secondary control links,
- Operating IFF transponder or beacon tracking system,
- Operational collision avoidance lighting,
- Operating tracking system, and
- Operational "auto pilot" return home feature.

CHAPTER 4

AIRPORT LIGHTING, MARKINGS, AND EQUIPMENT

Overview

Introduction

As an Air Traffic Controller, you must have a thorough knowledge of the airport layout, airfield markings, and airfield lighting equipment to effectively control aircraft and vehicular traffic on and in the vicinity of the airport. The information in this chapter will give you a basic understanding and enable you to make sound decisions based on your airfield's capabilities. This chapter does not cover everything with which you might possibly come in contact. Since improvements and new equipment come out all the time, make sure that you keep current with the equipment and changes at your airfield.

Objectives

The material in this chapter will enable you to:

- Identify standard airport markings.
- Identify the standards applicable to airfield lightings systems and indicate the functions of and operating rules for related components.
- Identify the different types of emergency recovery equipment and their uses.

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chanter:

Acronym	Meaning
AICUZ	Air installations compatible use zones
ARFF	Aircraft rescue and firefighting
ATC	Air traffic control
ATCF	Air traffic control facility
EOD	Explosive ordnance disposal
FAA	Federal Aviation Administration

Continued on next page

Acronyms (continued)

Table continued from page 4-1.

Acronym	Meaning
FAR	Federal Aviation Regulation
FCLP	Field carrier landing practice
GCA	Ground controlled approach
HIRL	High intensity runway lights
IFR	Instrument flight rules
ILS	Instrument landing system
LIRL	Low intensity runway lights
MIRL	Medium intensity runway lights
OLS	Optical landing system
PAPI	Precision approach path indicator
RCLS	Runway centerline lighting system
REIL	Runway end identifier lights
TACAN	Tactical air navigation
TDZL	Touchdown zone lighting
VASI	Visual approach slope indicator
VFR	Visual flight rules
VOR	VHF Omnidirectional range

Continued on next page

Topics

This chapter is divided into three sections:

Section A
Airport Layout

Overview

Introduction

The layout of each airport is unique. It is important that you become familiar with the location and function of all the different areas of your airfield. The better you know the layout of your airfield, the better service you can provide.

In this section

This section covers the following topics:

Airfield Facilities

Introduction

The *Facility Planning Criteria for Navy and Marine Corps Shore Installations,* NAVFAC P-80, provides planning criteria for determining the requirements for shore-based facilities needed to support fleet and Marine Corps operations. NAVFAC P-80 was written with several purposes in mind. One purpose was to ensure that the existing and planned facilities are neither too small nor too large to accomplish mission objectives. Another purpose was to establish common planning standards within the Navy and other services.

Runways

Runways are paved surfaces for the landing and takeoff of aircraft. The number of runways required is determined by the expected traffic density, airfield mission, operational procedures, and environmental factors. Runway orientation is determined by the analysis of wind data, terrain, noise levels, and planned local development.

Runway classification is dependent on the types of aircraft that operate from the runway and is not related to aircraft approach categories. Class A runways are used primarily for small aircraft operations; they don't have the potential for, or foreseeable requirement for, use by heavier aircraft. Class A runways are less than 8,000 feet long and less than 10 percent of the operations involve Class B type aircraft. All other runways are Class B runways except the basic training outlying fields used by T-34 aircraft for which special criteria apply.

The standard width for runways built before June of 1981 is 200 feet. After this date, the standard width is normally 75 feet for Class A runways and 200 feet for Class B runways. For detailed runway specifications and width exceptions refer to *Facility Planning Criteria for Navy and Marine Corps Shore Installations,* NAVFAC P-80.

AICUZ

The classification of Navy and Marine corps runways is determined as a part of the Air Installations Compatibility Use Zones (AICUZ) program. This program, which is defined in *Air Installations Compatibility Use Zones (AICUZ) Program,* OPNAVINST 11010.36, provides guidelines for achieving compatibility between air installations and neighboring communities. Each Navy air installation designated by the Chief of Naval Operations has an Air Installations Compatibility Use Zones (AICUZ) study.

Continued on next page

AICUZ (continued)

This study includes a detailed analysis of aircraft noise, accident potential, land-use compatibility, operational alternatives, and potential solutions to both existing and potential land-use problems. The foundation of the AICUZ program is an active local command effort to work with local communities to prevent incompatible development of land adjacent to military airfields.

Runway overrun areas

The primary purpose of runway overrun areas is to provide a reasonably effective deceleration area for aborting or overshooting aircraft. This area may also serve as an emergency all-weather access for fire-fighting, crash, and rescue equipment.

Some runways have paved overruns; these areas are marked with yellow chevrons across them. An area with this type of marking is unusable for landing, takeoff, and taxiing.

Taxiways

Taxiways are paved surfaces on which aircraft move under their own power to and from landing, service, and parking areas. Taxiway length depends upon the specific airfield configuration and layout of support facilities. Taxiways are normally 75 feet wide except for the taxiways that support only class A runways or helicopter landing pavements. Those taxiways are only 40 feet wide.

End turn-offs are planned for each Class B runway end and are 150 feet wide except those from parallel runways to the parallel taxiway. End turn-offs from parallel runways to the parallel taxiway are 200 feet wide. Normal intermediate turn-offs are required for all Class B runways. Normal intermediate turn-offs for Class B runways are 75 feet wide and are placed 2,000 feet from each end of the runway and in the remaining runway length at intervals of not more than 3,000 feet or less than 2,000 feet. High-speed turn-offs are provided where traffic studies indicate the requirement. High-speed turn-offs are 100 feet wide at the throat tapering to 75 feet and are a minimum of 1,000 feet long.

Taxiways are located to provide adequate clearance between taxiing aircraft, aircraft in adjacent areas, and other obstacles.

Continued on next page

Parking aprons

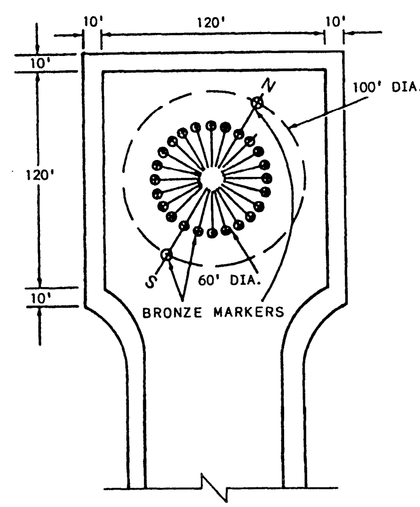
Parking aprons are required for parking, servicing, loading, and unloading aircraft. They are connected to the runways by taxiways or tow ways. There is no standard size or configuration for parking aprons. Parking apron sizes are based on the type and number of aircraft to be parked, the requirement for squadron integrity, and 45 versus 90 degree parking. The area required includes:

- parking space,
- wing-tip separation between aircraft,
- interior taxilanes, and
- peripheral taxilanes.

Compass calibration pad

An aircraft compass calibration pad is a paved area in a magnetically quiet area where the aircraft compass is calibrated. A minimum of one compass calibration pad is provided at each airport; however, additional pads may be required depending on local demands.

The pad surface is marked every 15 degrees to indicate magnetic bearings beginning with magnetic north. The taxiway to the compass rose is generally placed perpendicular to the taxiway with the least traffic. Brass or bronze is used in the construction of a compass rose since neither metal affects magnetic instruments. Other metal objects should be kept clear of the pad when the compass rose is in use. In the calibration of an aircraft compass, all electrical equipment is turned on and the engines are kept running to simulate actual flight conditions.



Runway Markings

Introduction

Airfield pavement markings are regulated by Federal Aviation Administration with overall Navy configuration control established by NAVAIRSYSCOM. The following information complies with current facility-design manuals and may differ slightly for some facilities built many years ago; however, future construction and modernization of existing facilities will meet these requirements. Airfield marking and lighting requirements for Navy and Marine Corps can be found in *General Requirements for Shorebased Airfield Marking and Lighting,* NAVAIR 51-50AAA-2.

Runway designation markings

Runways are numbered according to their inbound magnetic heading, rounded off to the nearest 10 degrees. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway. If the magnetic azimuth of the runway centerline is 5 degrees or more, the designation is the next higher number. If the whole number is less than 10, the runway designation number is preceded by a 0. For example:

- A runway centerline with a magnetic azimuth of 186 degrees will have the number 19 painted on the runway approach end. The whole number 186 is rounded to 190, and the zero is dropped.
- The opposite end of this runway will have a 01 painted on the runway approach end. The whole number 006 is rounded to 010, and the zero is dropped.

At airports that are using parallel runways, *L* indicates left, *R* indicates right, and *C* indicates center. All numbers and letters are painted retroreflective white.

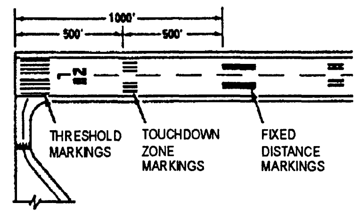
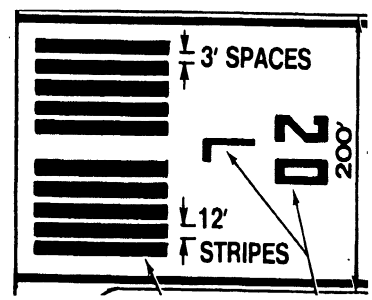
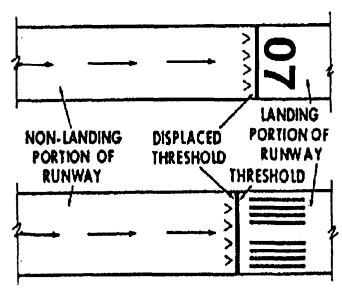
Runway centerline markings

Runway centerline markings consist of a broken line of 100- to 150-foot-long stripes separated by 60-foot minimum blank spaces. The first centerline stripe starts 40 feet from the top of the runway designation marking. The centerline stripes are 12 to 18 inches wide for basic runways and a minimum of 36 inches wide for other runways. Runway centerline markings are retroreflective white in color.

Continued on next page

Other runway markings

The table that follows contains other runway markings that you should be familiar with.

Marking or Marker	Description	Example
Precision approach instrument runway markings	Runway side stripes are painted on the precision instrument runway to further aid takeoff and landing guidance.	
Runway threshold markings	Runways 200 feet wide have 10 stripes marking the landing threshold, each 12 feet wide by 150 feet long. These stripes are separated by 3 feet except for the middle space, which has 16 feet between stripes. For all threshold markings, the color is retroreflective white.	
Displaced threshold markings	Yellow arrows 120 feet long, with 80-foot spacing between the arrows, are painted on the unused end of the runway pavement and point to the displaced threshold markings. Four yellow chevrons are also located on the approach side and point at a solid white transverse stripe. Displaced threshold markings are painted with nonretroreflective paint.	

Continued on next page

Other runway markings **(continued)**

Table continued from page 4-A-6.

Marking or Marker	Description	Example
Runway distance markers	Runway distance markers consist of a row of black and white vertical markers (signs) along each side of the runway that are spaced 1,000 feet longitudinally to inform pilots of the distance remaining on the runway in thousands of feet. The edges of the markers nearest the runway in each row must form a line not less than 50 feet and not more than 75 feet from the full-strength runway edge. The markers must not be less than 50 feet from the edge of any intersecting runway or taxiway.	

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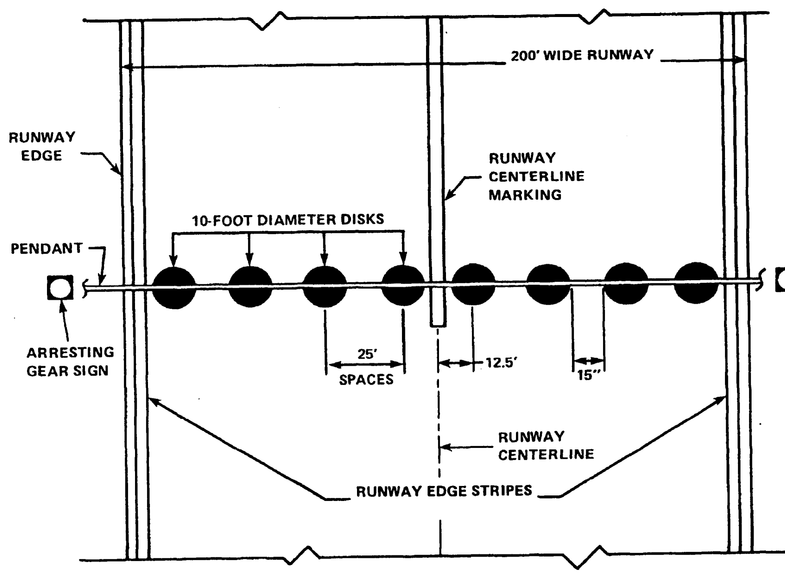
Arresting gear signs and markings

Arresting gear signs on both sides of the runway mark the location of arresting gear. These signs have large yellow circles on a black background. Also, a series of 10-foot-diameter retroreflective yellow disks that are painted in a line across the runway mark the location of the arresting gear pendant cable.



Taxiway Markings

Introduction

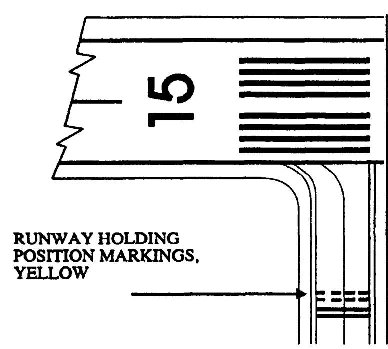
Taxiway markings are similar to runway markings and are regulated like other airfield pavement markings.

Taxiway centerline markings

Taxiway centerline markings consist of a continuous retroreflective yellow stripe not less than 6 inches wide along the taxiway axis. These markings provide taxiway identification and longitudinal guidance for steering the aircraft.

Standard holding position markings

Standard holding position markings are painted with retroreflective yellow paint and consist of two solid lines and two dashed lines that are 6 inches wide. They are placed across the taxiway at right angles to the taxiway centerline. When the taxiway is associated with a warmup pad, however, the holding line may be parallel to the centerline of the runway or taxiway that is intersected. These markings are used for holding aircraft at least 175 feet (250 feet preferred) clear of the nearest runway edge. Ground traffic must not proceed beyond the holding line marking without a control tower clearance. Category II holding position markings consist of two parallel solid lines with double connecting lines at 10-foot intervals, located not less than 400 feet from the runway centerline.



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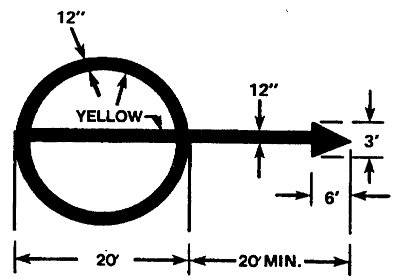
TACAN checkpoint markings

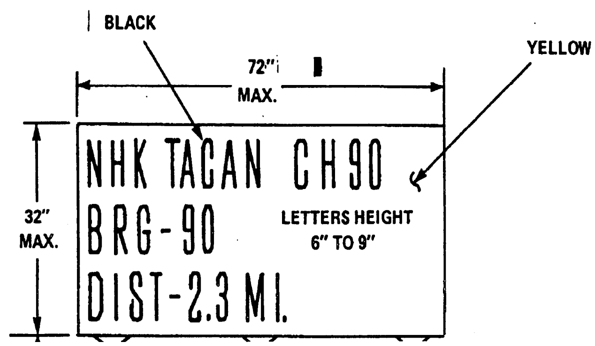
TACAN checkpoint markings are located on the taxiway centerline near the runway threshold. A 20-foot-diameter circle on the taxiway centerline marks each checkpoint. The circle marking stripe is nonretroreflective yellow and is 12 inches wide. A nonretroreflective yellow arrow, used by the pilot for aircraft alignment, crosses the circle and extends outside the circle for 20 feet. The arrow is 1 foot wide, and the arrowhead is 6 feet long and 3 feet wide. The arrow is omitted when aircraft alignment is not required.



DIRECTIONAL ALIGNMENT REQUIRED

TACAN checkpoint sign

TACAN checkpoint signs are used in conjunction with TACAN checkpoint markings. The pilot uses the information that the checkpoint sign provides when verifying the operation of a NAVAID in his or her aircraft before takeoff. The sign is placed at least 25 feet from the edge of the taxiway and not less than 200 feet from the runway edge. The sign is normally located on the same side of the taxiway as the turn onto the runway. The sign informs the pilot of the identification code and type of NAVAID, radio channel, magnetic bearing, and the distance in nautical miles to the transmitting antenna from the checkpoint. The sign has black characters on a yellow background.



Closed, Hazardous, and Other Area Markings

Introduction

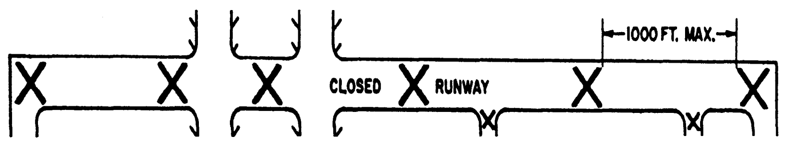
Where an operational requirement exists, there are provisions for marking closed, hazardous, and other airport areas.

Closed area

A closed area may be a runway, taxiway, or any other movement area (for example, parking apron) that was once used but is no longer considered usable. It may be a temporary condition, such as during construction, or permanently closed.

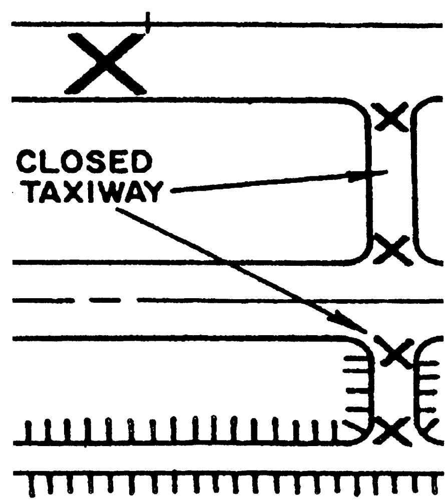
Closed runway markings

Closed runways are marked with crosses at each end, near the entrances to intersecting active runways and taxiways, and at intervals not greater than 1,000 feet. The crosses are painted with nonretroreflective yellow paint. The arms of the crosses intersect at right angles and are 10 feet wide and 60 feet in overall length.



Closed taxiway markings

Closed taxiways are marked with crosses at each end and at potential entrances and intersections with active runways or taxiways. Crosses also appear at intervals not greater than 1,000 feet apart along the closed length. These crosses are painted with nonretroreflective yellow paint. The arms of the crosses intersect at right angles and are not less than 5 feet wide and 30 feet in overall length.



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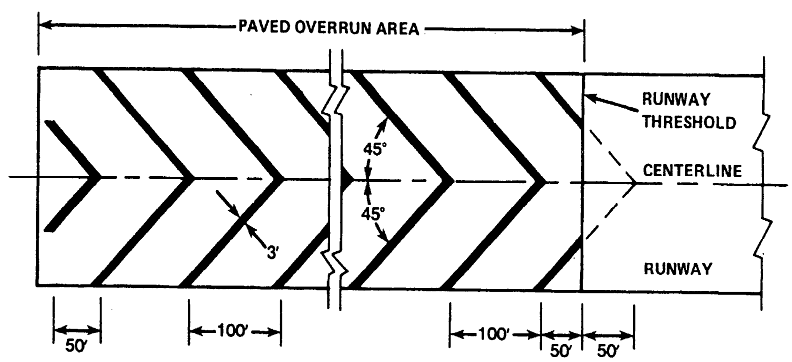
Hazardous area markings

Hazardous or failed areas of a taxiway are marked to preclude aircraft from taxiing on them. The hazardous area on the traffic side of the taxiway is outlined with a pair of parallel retroflective yellow lines. The area should also be outlined with yellow or orange rectangular flags not less than 18 inches on each side. Orange or orange and white cones can also be used. Flags and cones should be 30 inches or less in height.

Runway overrun markings

Paved overrun areas could easily be mistaken for a landing area. Therefore, runway overrun markings are used on them. These markings are in the shape of a chevron or partial chevron and are painted with nonretroreflective yellow paint. The apex of each chevron is at the runway centerline and each chevron leg makes an angle of 45 degrees to the centerline. The chevrons are equally spaced at 100-foot intervals through the paved overrun area. The legs of the chevrons are 3 feet wide and extend out to the edge of the paved area but not more than 100 feet on each side of the centerline.



NOTE: COLOR OF CHEVRON MARKINGS IS NONRETROREFLECTIVE YELLOW

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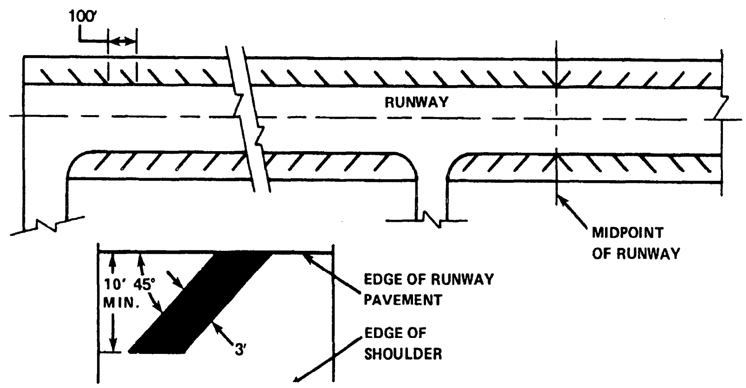
Runway shoulder markings

Runway shoulder markings consist of diagonal stripes at 45 degrees to the runway edges uniformly spaced at 100-foot intervals. These stripes should point away from the runway ends with the change in direction at the runway midpoint. Runway shoulder markings are painted with nonretroreflective yellow paint. The stripes are 3 feet wide and extend at least 10 feet from the runway edge.



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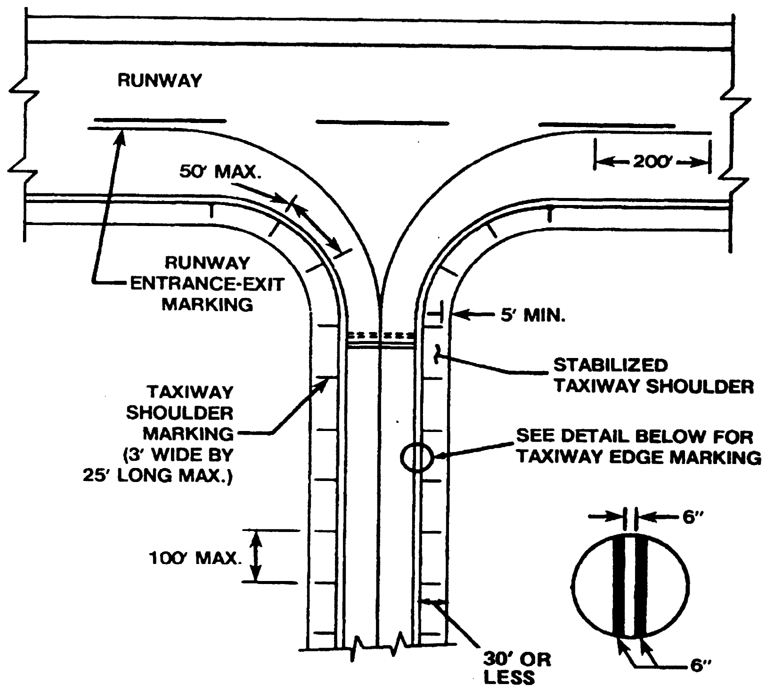
Taxiway shoulder markings

Taxiway shoulder markings consist of bars perpendicular to the taxiing area edge. On straight taxiway segments, the bars are spaced along the edge not more than 100 feet apart. On curved taxiway segments, the bars are spaced along the edge not more than 50 feet apart. Taxiway shoulder markings are painted with nonretroreflective yellow paint. The bars are at least 3 feet wide and are 25 feet long or to within 5 feet of the outer edge of the shoulder paving, whichever is less.



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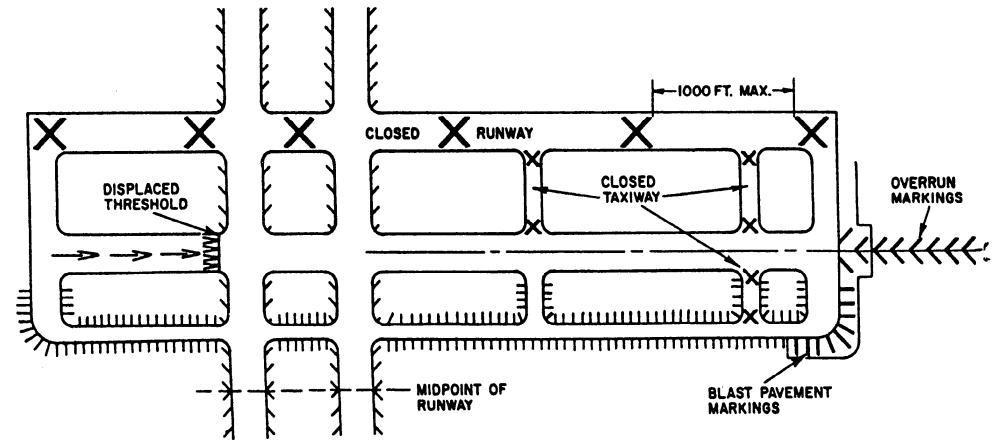
Overhead view

The figure below shows an overhead view of an airfield and its markings and markers. For more information concerning airport markings and markers refer to *General Requirements for Shorebased Airfield Marking and Lighting,* NAVAIR 51-50AAA-2.



Carrier deck marking

Those naval air stations that train pilots ashore for landing aircraft on carriers at sea are equipped with a simulated carrier deck on runway ends selected for FCLP. The carrier deck's placement is dependent on the location of the OLS. Carrier deck markings consist of centerline, edge, and ramp athwartship markings. The markings are nonretroreflective white except for the alternating sections of the centerline markings that are nonretroreflective yellow. Carrier deck markings supersede runway markings in areas where they conflict. The carrier deck centerline is parallel to and left of the runway centerline. The length of the simulated carrier deck is 778 feet.

Section B
Airfield Lighting Systems and Operations

Overview

Introduction

Airport lighting systems are standardized by the Air Force, Navy, and the FAA to present a uniform and unmistakable appearance. These standards specify the location, spacing, and color of lighting components in use. Flight personnel familiar with the standards can readily interpret the lighting aids at any airfield.

An airfield lighting system consists of runway lighting and other lighting aids along with their controls and power supplies. The major lighting aids that could be installed to support an airport's mission are considered in this section.

Procedure

Procedures for the operation of airport lighting are in Air *Traffic Control,* FAA Order 7110.65. Operation of airport lighting at controlled airports is normally the responsibility of the tower. When the airfield is closed, all associated lighting is shut down with the following exceptions:

- Navigable airspace obstruction lights as outlined in *FAR,* Part 77, that are not associated with the closed airport
- Rotating beacons if used as navigation reference points or visual landmarks

Since the airport lighting system is controlled from the tower, you must know how and when to operate the various components. You might think that you turn everything on at sunset and off at sunrise, but this is not the case.

In this section

This section covers the following topics:

Aeronautical Beacons

Introduction

The aeronautical beacon is a visual aid. Beacons indicate the location of an airport, a landmark, a hazard, or an obstruction to air navigation. The principal light in a beacon rotates or flashes and is of relatively high intensity.

The color or color combination displayed by a particular beacon indicates whether the beacon marks a landing place, a landmark, a hazard, or obstruction. The common types of beacons are the airport rotating beacon, the identification or code beacon, and the hazard or obstruction beacons.

Airport rotating beacons

An airport rotating beacon is required at each airfield unless adjacent airfields share a common beacon. The following table contains pertinent facts about airport rotating beacons:

Airport Rotating Beacon Facts	
Rotation	Rotation is 6 revolutions per minute and in a clockwise direction when viewed from above. Is always rotated at a constant speed, which produces the visual effect of flashes at regular intervals. Flashes may be alternately given as one color or two colors. The signal from the beacon must be visible for 360 degrees.
Location	Located not less than 1,000 feet from the centerline or centerline extended from the nearest runway and not more than 5,000 feet from the nearest point of the usable landing area. Is located 750 feet or more from the control tower. Base must be at least 20 feet higher than the elevation of the floor of the tower cab.

Continued on next page

Airport rotating beacons (continued)

Table continued from page 4-B-2.

Airport Rotating Beacon Facts	
Operation	An airport rotating beacon is operated as follows: • Sunset to sunrise-Continuously during airfield operations • Sunrise to sunset-When the reported ceiling or visibility is below basic VFR minimums
Color scheme	The colors and color combinations of lights for rotating beacons and their meanings are as follows: • A lighted land military airport–Alternating dual peaked (two quick) white between green flashes • A lighted land civilian airport–Alternating white and green • A lighted water airport–Alternating white and yellow

Identification or code beacon

An identification or code beacon is required when the airport rotating beacon is more than 5,000 feet from the nearest runway or where the rotating beacon serves more than one airfield.

This beacon is a nonrotating flashing omni-directional light visible through 360 degrees. The identification or code beacon flashes a color-coded signal at approximately 40 flashes per minute. The signal is assigned a code of characters to identify a particular airfield. The identification beacon shall be operated whenever the associated airport rotating beacon is operated.

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Obstruction lighting

Obstruction lighting consists of flashing and steady-burning red lights. Extremely tall structures require high-intensity strobe lights during both day and night. Obstruction lights are used to define the vertical and horizontal limits of objects that are hazardous to aircraft operation. These obstruction objects include permanent construction hazards, natural hazards, fixed equipment, and all installations that encroach on the standard airfield clearance surfaces. When repair or construction constitutes a temporary hazard to air navigation, these areas must be adequately lighted with temporary obstruction lights.

Obstructions are defined as those objects that penetrate the imaginary surfaces defined in *Airfield Safety Clearances,* NAVFAC P-80.3. The requirements for lighting obstructions and other hazards to air navigation are set forth in the *General Requirements for Shorebased Airfield Marking and Lighting,* NAVAIR 51-50AAA-2.

Runway Lighting

Introduction

Various runway lights are installed at airports to provide visual guidance at night and under low-visibility conditions for aircraft during takeoff and landing.

Runway light system classifications

Runway light systems are classified according to the intensity or brightness that they produce; they are high-intensity runway lights (HIRLs), medium-intensity runway lights (MIRLs), and low-intensity runway lights (LIRLs). Navy requirements indicate that HIRLs shall be used for all new runway edge lighting installations and should be considered for replacement or improvements of existing runway edge lighting systems.

Runway edge lights

Runway edge lights form the outline of the runway for night operations or during periods of reduced visibility. These lights are on both sides of the runway, extending the entire length. Runway edge lights are spaced a maximum of 200 feet apart. Runway edge lights are bidirectional white lights. The last 2,000 feet of the runway or one-half of the runway length, whichever is less, is displayed by the lights as aviation yellow on instrument runways. Except at intersections where semiflush runway edge lights are used to maintain uniform spacing or within the area of the arresting gear tape sweep, runway edge lights are elevated.

Threshold lights

Threshold lights are installed to provide positive identification of the beginning of the operational runway surface for approaching aircraft at night or during periods of reduced visibility. Threshold lights are installed in a straight line at the end of each runway perpendicular to the runway centerline. The outboard lights are unidirectional (toward the aircraft approach path) green lights. The inboard lights are green but may be bidirectional with red beams (toward the runway) for runway end lights. Threshold lights are connected to and form an integral part of the runway edge light circuit.

Runway end identification lights

Runway end identification (identifier) lights (REIL) provide the pilot with rapid and positive identification of the runway threshold during an approach for landing. REILs are effective for overriding surrounding lighting that might cause pilot confusion such as in the following situations:

Continued on next page

Runway end identification lights (continued)

- General preponderance of metropolitan or other lighting located within two miles of the circling approach to the runway
- Configuration of nonaviation lighting such as boulevard, expressway, or railroad yard that presents a false or misleading runway identification

REILs consist of flashing light fixtures (strobe lights), one located on each side of the runway threshold. REILs can be either uni- or omnidirectional and flash at a rate of 90 (plus or minus 30) flashes per minute. These lights are installed in line with the threshold lights and 50 feet outboard from each side of the runway edge. REILs are operated when the associated runway edge lights are lighted.

Runway centerline lights and touchdown zone lights

The runway centerline lights (RCL) provide visual aid to assist the pilot in keeping the aircraft centered on the runway during takeoff and after landing at night or in reduced visibility conditions. RCL, where installed, consist of a single row of lights at uniform intervals of 25 feet apart (50 feet for FAA type lights) along the centerline of the runway to provide a continuous lighting reference from threshold to threshold of the runway. The lights are semiflush and bidirectional. Centerline lighting may be installed on primary and secondary runways. Runway centerline lights are white from the threshold to a point 3,000 feet from the runway end. They alternate colors of red and white from 3,000 feet to 1,000 feet from the runway end and are red in color from 1,000 feet to the runway end. The intensity should be the same as that of the high-intensity runway lights.

Touchdown zone lights (TDZL) provide visual guidance during final approach and landing and indicate the portion of the runway used for touchdown. These are semiflush white unidirectional lights that are located on each side of the runway centerline in a line perpendicular to the runway centerline lights. They generally extend from the landing threshold to 3,000 feet down the runway at 100-foot intervals.

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Taxiway lighting

Taxiway edge lights are blue. Their spacing is variable and depends upon the length of a straight segment of a taxiway or the radius of curvature on a taxiway turn. On straight segments over 300 feet in length with lighting along both edges, lights are placed up to 200 feet apart. On straight segments over 300 feet in length with lights along one edge, lights are placed up to 100 feet apart. On straight segments of 300 feet or less with lights along one or both edges, lights are placed up to 50 feet apart. Taxiway lights that mark a curved edge of a taxiway follow the rule that the sharper the radius of curvature, the closer the lights are placed.

At some naval air stations, taxiway centerline lights are used to supplement edge lights wherever more positive guidance of aircraft is necessary, such as at complex taxiway intersections or large ramp areas where pilot confusion might occur. They are also used to add directional guidance at high speed taxiway exits. Taxiway centerline lights are green in color.

The control system for taxiway lights permits the lighting of individual taxiways or combinations of taxiways to illuminate selected taxi routes. Control of taxiway centerline lights may be separate from or combined with taxiway edge lights.

Approach lights

Approach lighting systems of varying types, colors, and construction have been specifically developed to meet civil and military requirements. These lights are installed in an area extending outward from the threshold of the instrument runway and are usually the pilot's first visual contact with the ground under extremely low-visibility conditions. Electronic landing aids such as GCA and ILS are used to bring the pilot down to approach minimums. Approach lights are required for the pilot's final alignment with the runway, and runway lights are required for completion of the landing.

High-intensity incandescent lights penetrate farther through fog, smoke, or rain than neon lights. Neon approach lights are being replaced by high-intensity incandescent approach lights in the United States.

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Approach lights (continued)

The approach lighting system normally consists of a series of crossbars of white lights placed perpendicular to the extended runway centerline and spaced for a distance of 3,000 feet from the runway threshold. The system also includes high-intensity blue-white sequence flashing lights (strobes) placed on the extended centerline from 1,000 feet to 3,000 feet from the runway threshold.

The intensity of the approach lights can be varied from the control tower. To be most useful, the lights must be sufficiently bright to penetrate the overcast effectively without blinding the pilot or producing halo effects. The sequenced flashing lights are controlled independently of other lights and are either on or off. They are, however, a component of the approach lights; therefore, the approach lights must be on before the sequenced flashing lights will operate. You should be alert during periods of low visibility and fog because the pilot will often request "strobes off" on short final. When rebounding off the fog, strobe lights can give off a blinding effect to the pilot.

Information about the various configurations of approach lighting systems available today is contained in both the *Flight Information Handbook* and the *Aeronautical Information Manual.* Lighting requirements for air traffic control purposes can be found in *Air Traffic Control,* FAA Order 7110.65.

Miscellaneous Airport Lighting

Introduction

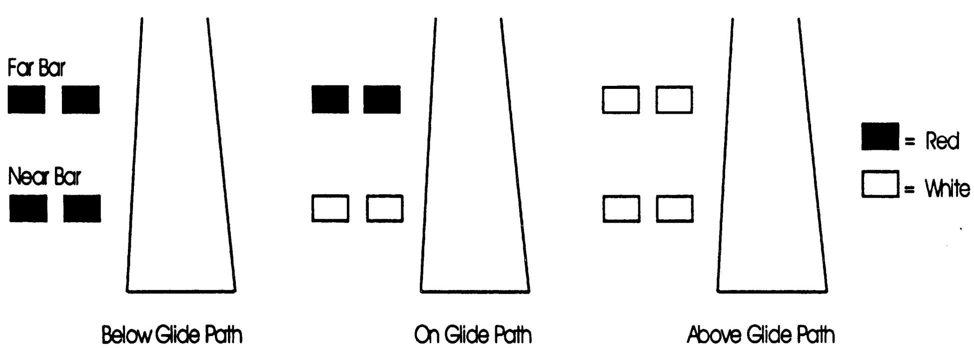
There are a number of other lighting systems that you should be aware of as an air traffic controller. Your facility may have some, all, or none of these systems. Whatever the case, you should become completely familiar with the systems at your facility.

Visual approach slope indicator

The visual approach slope indicator (VASI) is designed to provide visual descent guidance information during the approach to a runway. The two-bar VASI system provides one visual glide path normally set at 3 degrees. A three-bar system provides two visual glide paths. The lower glide path is normally set at three degrees, and the higher glide path is normally set a 1/4 of a degree higher. Local obstruction may cause a facility to have a different glide path angle than listed here. The VASI system consists of red and white lights located beside the runway that provide the pilot with the following glide slope information.

Aircraft Position	Presentation
Above the glide slope	white over white
On the glide slope	red over white
Below the glide slope	red over red

The light units are so arranged that the pilot, during an approach, would see one of the combinations below.



For more complete information on the VASI system refer to the *AIM.*

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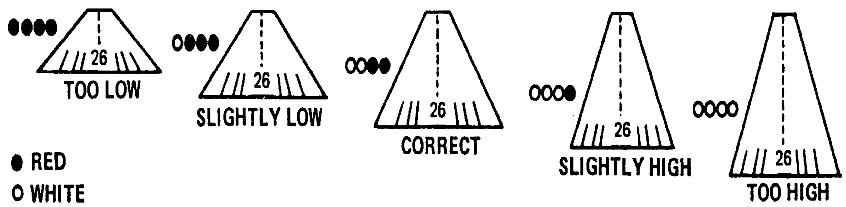
Precision approach path indicator

With the precision approach path indicator (PAPI), the pilot sees a single row of either two or four lights. The visual range of PAPI is approximately 5 miles during the day and up to 20 miles at night. PAPI lights are normally installed on the left side of the runway. PAPI lighting configurations and meanings are depicted below.



PAPI PATTERNS AS SEEN FROM THE APPROACH ZONE

If more lights are seen as red by the pilot, his or her aircraft is too low. If more lights are seen as white by the pilot, his or her aircraft is too high. Navy requirements indicate that PAPI should be installed when entire VASI systems require replacement.

Obstruction lights

Obstruction lights are on all elevated obstructions on the airport and all other obstructions within a given glide angle of an airport. Obstruction lighting includes flashing beacons and steady-burning lights; both are aviation red. Some on-airport obstruction lights are manually controlled from the tower; most obstruction lights have automatic photoelectric switches.

Optical landing system

Many naval air stations have a **Fresnel lens optical landing system (FLOLS)** installed abeam the touchdown point along the left side of a runway used for field carrier-landing practice. The **optical landing system (OLS)** provides glide slope information independent of other visual aids; however, it does not provide centerline alignment information. The OLS is normally turned on whenever that runway is being used. Although the shore-based lens may differ physically from the shipboard lens, the view presented to the pilot is the same in either case.

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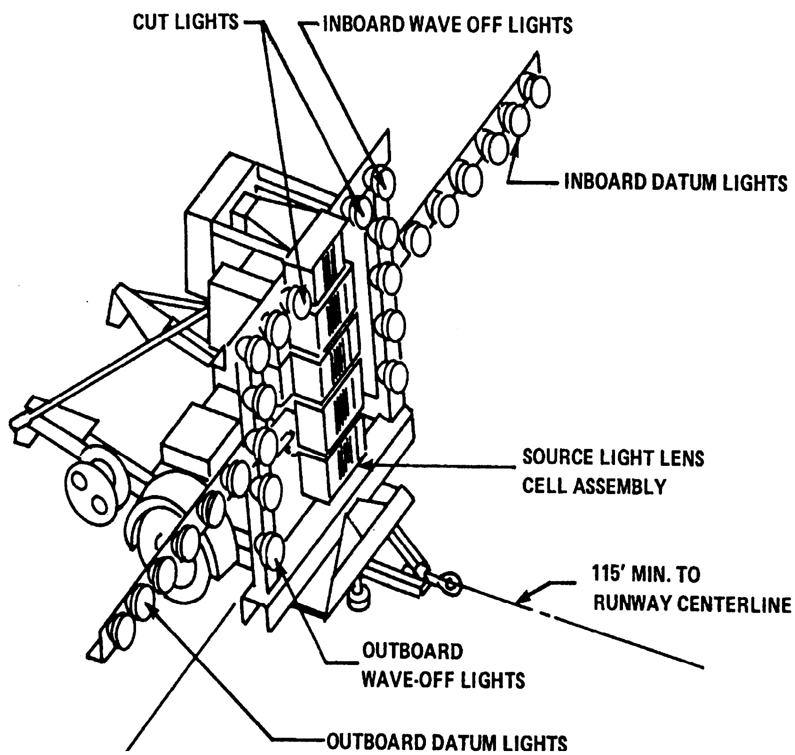
Optical landing system (continued)

The OLS consists of the following lighting components:

- Source Lights—yellow line of lights referred to as the "meatball" or "ball." A red source light is visible to the pilot when the aircraft is too low.
- Datum Lights—horizontal bar of green lights that provides a visual reference for determining the aircraft's position in relation to ideal glide path
- Wave-off Lights—flashing red lights to inform the pilot to execute a missed approach. Operated by the LSO during FCLPs.
- Cut Lights—green lights above the source lights. Used by the LSO to acknowledge control of a NORDO (no radio) aircraft.



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Miscellaneous Airport Lighting, Continued

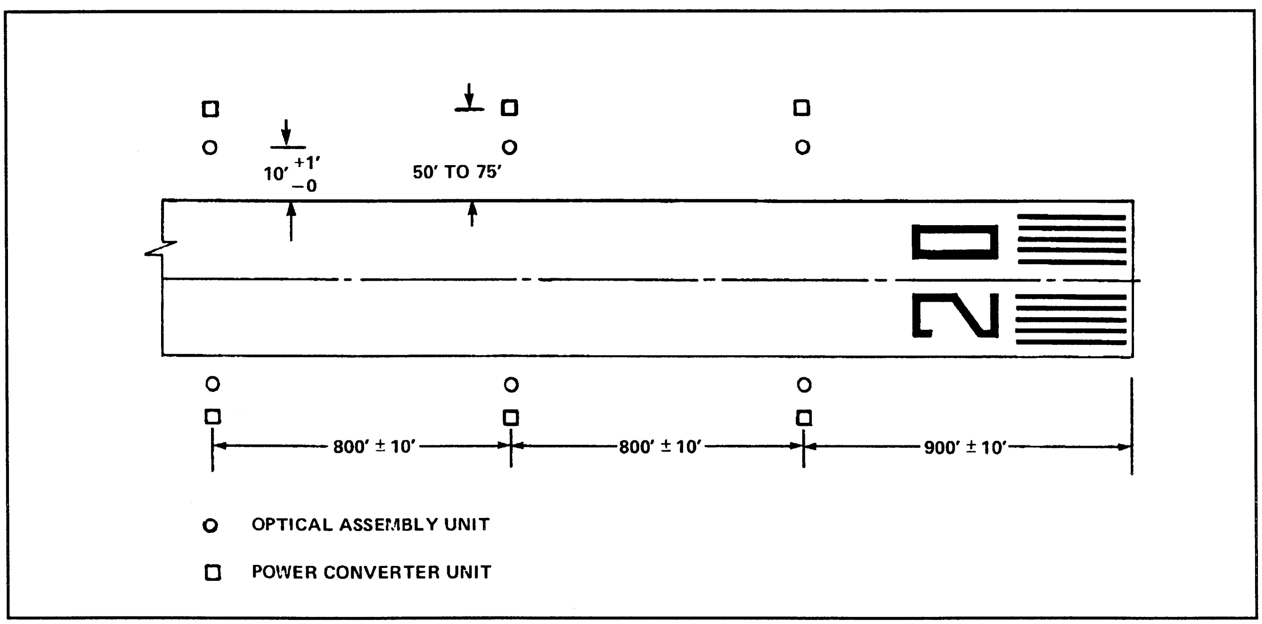
Wheels-up lights

The wheels-up lights are a bar of lights located in the approach area for illuminating the underside of aircraft preparing for landing. This light bar consists of 20 white lights in a line perpendicular to the extended runway centerline. The light beams project upward and toward the runway threshold. The light bar is on the same side of the extended runway centerline as is the air traffic control tower.

Runway wave-off lights

The runway wave-off lights consist of six lights, three lights along each side of the runway in the touchdown area. These lights present a high-intensity red flashing signal to inform the pilot approaching for a landing to execute an emergency wave-off or missed approach procedure. The lights are in pairs outboard of the runway edges. The runway wave-off lights are activated by either the control tower operators or wheels watch.

The red strobe lights are used for new installations and as replacements of existing installations. The three-lamp cluster, flashing, red incandescent lights are obsolete.



Section C
Miscellaneous Airfield Equipment and Emergency Systems

Overview

Introduction

There are a number of other systems and pieces of equipment that you should be aware of as an air traffic controller.

In this section

This section covers the following topics:

Wind Cones

Introduction

Wind cones (socks) are installed at the approach end of all runways and in the vicinity of helipads. They provide pilots with visual information of surface wind direction and general indication of wind speed. This information is most useful during takeoff, for orientation to make an approach, and in the final phase of approach prior to touchdown.

Wind cones

Air passing through the wind cone aligns the wind cone with the wind to indicate the direction from which the wind is blowing. The wind cone has an advantage over the wind tee in that, besides indicating the direction, it also gives an approximation of wind velocity.

The velocity of the surface wind can be approximated by comparing the angle of the wind cone in its relation to the ground. The wind cone will stand out parallel with the ground when the wind is 15 to 20 knots. Since the wind cone stands out parallel to the ground with a steady wind greater than 20 knots, the pilot must exercise caution when the wind cone is his or her only available reference. A gusty wind is indicated when the wind cone alternately rises and falls rapidly. When the wind cone hangs limply at the mast, a calm wind is indicated. Should the wind cone swing from side to side and rise and fall, gusty, shifting wind is indicated.

The wind cone may be orange or white. If night flight operations are conducted, the wind cone shall be lighted.

Mobile Communications and Control Vans

Introduction

Some ATC facilities have a mobile control tower or radio communications van for the Air Traffic Controller to use as temporary operating facilities when the need arises.

Mobile communications and control vans

These vans are used during periods of equipment outages in the main control tower. They may also be used by the LSO when field carrier-landing practice (FCLP) is being conducted. Also, this equipment is used when special on-airfield operations or tests/evaluations require real-time coordination with the controllers in the primary control tower.

The mobile control tower provides the controller with the minimum equipment to perform his or her duties satisfactorily, especially when traffic conditions are relatively light. Normally, when these temporary facilities are in use, local procedures limit the tempo of airport flight operations.

Emergency Power

Introduction

An emergency generator or other independent power source at each ATC facility ensures continuous operation of the facility should the primary power source fail.

Responsibility

Commanding officers are responsible for the plans and procedures to ensure the continuity of air traffic control services and navigational aids during emergency conditions such as power failure, fire, flood, and storm damage. For use in emergency conditions, auxiliary power sources must be maintained in optimum operational condition. To ensure maximum continuity of ATC service, each ATC facility has a preventive maintenance program and a periodic load operation and no-load operation.

Use of auxiliary power during severe weather

Weather reports, advisories, and radar are monitored to determine when severe weather activity is approaching the facility. Facilities that lack reliable automatic transfer equipment for auxiliary power must shift to auxiliary power at least 30 minutes before severe weather is expected to arrive. The ATCF Officer directs the use of auxiliary power generators for related facilities and navigational aids.

Emergency and Crash Procedures

Introduction

The facilities for fighting fires and aiding personnel involved in crashes are a vital part of airport equipment.

Emergency procedures cannot always be prescribed for every situation. An emergency includes any situation where an aircraft is in danger, lost, or in distress. When it is believed that an emergency exists or is imminent, you as an air traffic controller, must select and pursue a course of action that appears to be most appropriate under the existing circumstances. You base your decision on what course of action is needed by the pilot's request and the information he or she provides. The pilot determines what course of action he or she will take. This TRAMAN covers only general emergency procedures.

Crash/search and rescue bill

All air stations maintain a current crash bill, which details the duties of personnel handling emergencies. The **Crash/Search and Rescue Bill** is normally contained in the station's *Air Operations Manual.* Some air stations have stand-alone bills.

Primary crash-phone circuit

The primary crash-phone circuit is a direct-wired intercommunications system that is installed between stations involved in emergency responses. The system's purpose is to provide an immediate means of communication to primary emergency activities so they may notify all essential supporting activities. The primary crash-phone circuit must be installed at the following locations:

- Air traffic control tower (initiating agency)
- Aircraft fire and rescue alarm room
- Structural fire and rescue alarm room
- Air operations duty office
- Station hospital or dispensary
- SAR organization (if applicable)

When activating the crash-phone system, you should give at a minimum the following information, if available:

- Location
- Type of aircraft
- Nature of emergency

Continued on next page

Primary crash-phone circuit

- Fuel state
- Number of personnel aboard
- Explosives, ordnance stores, or other dangerous cargo
- Landing runway and estimated time of arrival
- Any other pertinent information

Secondary crash-phone circuit

The secondary crash-phone circuit can be activated from the control tower or from the flight planning desk. On this circuit, telephone receivers are installed, as required, at each facility. The following receiving stations are usually on this circuit:

- Aircraft fire and rescue alarm room
- Structural fire organization
- Hospital or dispensary
- Photographic laboratory
- Aircraft maintenance department
- EOD personnel
- Aircraft rescue boat house (if applicable)
- Security office
- Operations office

This circuit allows notification of all essential personnel and activities simultaneously by the flight planning dispatcher without further interference with control tower operations.

Crash-phone circuit testing

The crash phone is tested daily at all facilities to make sure it operates satisfactorily. This test is usually originated by the control tower on the primary crash-phone circuit and is followed by a test of the secondary crash-phone circuit by flight planning.

Continued on next page

Emergency radio communication systems

Two radio networks coordinate crash and fire-fighting activities. The primary network is referred to as the **crash network** (or crash net). The crash network provides communications between ‘the control tower and necessary mobile units such as crash trucks and ambulances. The other network is used as a standby or spare in case of an outage of the primary network. This secondary network is sometimes referred to as the **internal security network.**

Emergency responsibilities

Depending on the phase of flight or the ground location an aircraft is in when it encounters an emergency or has a crash, any air traffic control activity can receive the initial information on the occurrence. When an emergency or crash occurs, control tower personnel must speedily convey the exact information to crash, fire-fighting, and rescue units and keep the units advised of the status and pertinent details of the incident. Also, tower personnel must closely observe all activity on the airfield and within the visible traffic pattern and should notify traffic on the field and airborne aircraft under control tower jurisdiction if the crash or emergency will affect airfield operations. At the direction of the operations officer or his or her representative, tower personnel must close the airfield to traffic until the field is free for normal operations.

Describing aircraft crashes

Aircraft crashes are usually described as to location by the use of a grid map system especially constructed for crashes. Sometimes it is desirable to construct two grid maps. One map is used for crashes on or near the airport, and one map is expanded to cover more area for off-station crashes. In either case, the tower crash grid map must coincide with the grid map that is provided to the various emergency response vehicles, Operations Duty Officer, security dispatcher, crash-fire dispatcher, hospital or dispensary, SAR team, and emergency operations center.

An emergency or crash generates excitement. However, since you are transmitting very vital information, it is extremely important that you be **CORRECT, CONCISE,** and **CALM.** Remember that you are talking to several people at one time and that these people must absorb the information in order to take proper action.

Continued on next page

Immediate response alert

An immediate response alert must be maintained at all times while landings and takeoffs are being conducted. The purpose of the immediate response alert is to provide immediate response to observed, unanticipated emergencies and to control such fires until the standby alert can effect rescue and fire extinguishment. This alert must be strategically located on the airfield to observe all takeoffs and landings and to respond immediately to an emergency. Immediate response alert must consist of a major aircraft rescue and firefighting (ARFF) vehicle manned to provide initial fire control capabilities. ARFF vehicle and manning requirements are outlined in *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual,* NAVAIR 00-80R-14.

Standby alert

At all times during flight operations, a standby alert must be maintained. Such an alert must consist of the remaining complement of manned major ARFF vehicles to meet minimum response requirements of the airfield. This alert must be maintained to permit arrival at midpoint of the farthest runway supported within 3 minutes. Upon notification of an anticipated or impending emergency landing, the standby alert must assume the condition of readiness of immediate response alert at predesignated strategic positions on the airfield.

Backup standby alert

During flight operations, a backup standby alert consisting of other medical or ambulance personnel, EOD personnel, and the structural fire companies must be maintained in a condition of readiness that will permit prompt response from normal working areas to a standby alert position. Upon notification of an emergency, these forces will assume the condition of readiness of the standby alert and await instructions from the senior fire officer at the scene of the emergency.

Emergency Recovery Equipment

Introduction

Emergency recovery equipment is installed at naval airfields to provide a means of bringing tailhook-equipped aircraft to a safe stop whenever normal landing procedures cannot be used.

Emergency recovery equipment may be used for an aircraft that has a blown tire or has a partial failure of its hydraulic system. The results of the hydraulic system failure could be a possible loss of brakes, and quite frequently, the inability of the aircraft to lower part or all of its landing gear.

The ATC facility manual for your station will have a detailed diagram and explanation of terms for the gear used at your facility.

E-5 emergency chain-type arresting gear

The chain gear is mostly used as an overrun backup arresting system. The E-5 chain-type emergency arresting gear uses the principle of dragging weight behind an aircraft to stop it. In this instance, the weight is a chain that has been positioned on the runway parallel to and approximately 1 foot inboard from the edges. Two cross-deck pendants (cables stretched across the runway) attached to the ends of the chain permit the aircraft to be arrested. The tailhook catches the cross-deck pendant and drags the chain until the aircraft comes to a stop.

E-28 emergency runway arresting gear

The E-28 runway arresting gear is a rotary hydraulic system. It is fast and efficient and needs little maintenance. It can arrest hook-equipped aircraft in all types of landings. The simplicity of the gear's structure and its high reliability make it a superior system. The cycle time for reuse is approximately 80 seconds.

CHAPTER 5

AIR TRAFFIC CONTROL EQUIPMENT

Overview

Introduction

Your job as an air traffic controller is to effect the safe, orderly, expeditious movement of aircraft. You must also control vehicular and pedestrian traffic on the airfield. To do this, you use radios, radar, and signaling devices to provide information and instructions relative to the traffic. The equipment that we will discuss in this chapter are the tools of your trade. That you understand your equipment capabilities and limitations is important. You cannot perform your duties without a thorough understanding of the equipment available to you.

Objectives

The material in this chapter will enable you to:

- Identify and describe the types and functions of various equipment found in most naval control towers.
- State the principle upon which radar operates and the general function of major components of a typical radar set. Identify the types, uses, and operating characteristics of ATC radar systems.
- Identify the uses, functions, and capabilities of equipment used by ATC personnel aboard ship.

Acronyms

The following table contains a list if acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
AFC	Automatic frequency control
AFLCS	Airfield lighting control system
ARTCC	Air route traffic control center

Continued on next page

Acronyms (continued)

Table continued from page 5-1.

Acronym	Meaning
ARTS	Automated radar terminal system
ASR	Airport surveillance radar
ATC	Air traffic control
ATCF	Air traffic control facility
ATCRBS	Air traffic control radar beacon system
ATIS	Automatic terminal information service
AZ	Azimuth
BRANDS	BRITE radar alphanumeric display system
BRITE	Bright radar indicator tower equipment
CATCC	Carrier air traffic control center
CCA	Carrier controlled approach
CCTV	Closed-circuit TV
CDC	Combat direction center
CP	Circular polarization
CRT	Cathode-ray tube
DAIR	Direct altitude and identity readout
DoD	Department of Defense
EL	Elevation
ETVS	Enhanced terminal voice switch
FAA	Federal Aviation Administration

Continued on next page

Acronyms (continued)

Table continued from page 5-2.

Acronym	Meaning
FACSFAC	Fleet area control and surveillance facility
FACTS	FACSFAC air control tracking system
FLOLS	Fresnel lens optical landing system
FTC	Fast time constant
GCA	Ground controlled approach
ICLS	Instrument carrier landing system
IFF	Identification friend or foe
ILARTS	Integrated launch and recovery television surveillance system
ILM	Independent landing monitor
IFR	Instrument Flight Rules
IVCSS	Integrated voice communications switching system
JETDS	Joint electronics type designation system
LLWAS	Low-level wind-shear alert system
LSO	Landing signal officer
MOVLAS	Manually operated, visual landing aid system
MSL	Mean sea level
MTI	Moving target indicator
NAVAID	Navigational aid
NOTAM	Notice to airmen
PALS	Precision approach and landing system

Continued on next page

Acronyms (continued)

Table continued from page 5-3.

PAR	Precision approach radar
PPI	Plan position indicator
PRF	Pulse repetition frequency
SFA	Single-frequency approach
SIF	Selective identification feature
STC	Sensitivity time control
VFR	Visual Flight Rules
VIDS	Video information distribution system
VISCOM	Visual communications system

Topics

This chapter is divided into five sections:

Section A
Joint Electronics Type Designation System

Overview

Introduction

The Joint Electronics Type Designation System (JETDS), formerly known as the AN nomenclature system, was developed to standardize, within the DoD, identification of electronic material and associated equipment.

In this section

This section covers the following topic:

Designation System

Introduction

JETDS applies to developmental, preproduction, and production models of systems, groups, components, and subassemblies of electronic equipment for military use. Once assigned, a type designation will never be duplicated.

JETDS nomenclature

In the JETDS, nomenclature consists of a name followed by a type designation composed of indicator letters and an assigned number. A type designation assignment for a complete system, or set, consists of an AN (which is used to identify major items of electronic equipment), a slant bar, a series of three letters, a hyphen, and a number. An example of a type designator would be Radar Set AN/SPN-43, which is an air search radar set designed for CATCC use aboard ship.

The meanings of the three letters following the slant bar may be found in the following table:

Set Indicator Letter					
1st Letter Installation Class		**2nd Letter** Type of Equipment		**3rd Letter** Purpose	
A	Piloted aircraft	A	Invisible light, heat radiation	A	Auxiliary
B	Underwater mobile, submarine	C	Carrier	B	Bombing
C	Air transportable (inactivated, do not use)	D	Radiac	C	Communications (receiving and transmitting)
D	Pilotless carrier	E	Nupac	D	Direction finder, reconnaissance, and/or surveillance
F	Fixed Ground	F	Photographic	E	Ejection and/or release
G	Ground, general use	G	Telegraph or teletype	G	Fire control or searchlight directing

Continued on next page

JETDS nomenclature

Table continued from page 5-A-2.

Set Indicator Letter

1st Letter	**Installation Class**	**2nd Letter**	**Type of Equipment**	**3rd Letter**	**Purpose**
K	Amphibious	I	Interphone and public address	H	Recording and/or reproducing
M	Ground, mobile	J	Electromechanical or inertial wire covered	K	Computing
P	Portable	K	Telemetering	M	Maintenance and test assembly
S	Water surface	L	Countermeasures	N	Navigational aids
T	Ground transportable	M	Meteorological	Q	Special or combination
U	General utility	N	Sound in air	R	Receiving, passive, detecting
V	Ground vehicular	P	Radar	S	Detecting and/or range and bearing, search
W	Water surface and underwater combination	Q	Sonar and underwater sound	T	Transmitting
		R	Radio	W	Automatic flight or remote control
		S	Special types or combinations of types	X	Identification and recognition
		T	Telephone (wire)		
		V	Visual and visible light		
		W	Armament		
		X	Facsimile		
		Y	Data processing		

Section B
ATC Communications and Coordination Equipment

Overview

Introduction

Some ATC equipment is used in both the control tower and the radar room. Controllers must become familiar with this equipment and its function in each ATC branch.

In this section

This section covers the following topics:

Communications Consoles

Introduction

Radio is the primary means of communications with aircraft both in the air and on the ground. Different radio frequencies are established for a particular type of operation. For example, most Navy towers have the 340.2 MHz, 360.2 MHz, 134.1 MHz, and 126.2 MHz frequencies assigned specifically for airport traffic control purposes. But different operating positions within the same facility may have to share the same frequency for a particular aircraft due to operational necessity or an emergency.

A single-piloted IFR aircraft, for example, should be provided a single-frequency approach (SFA) to the maximum extent that communications traffic conditions permit. In this case, the radar facility and the control tower may find it necessary to share the same frequency sometime during an aircraft's approach. Operational requirements at some airfields may dictate that the frequency control authority establish additional frequencies for air traffic control.

Additionally, interfacility communications may be necessary for coordination between the different operating positions where physical contact between controllers is not possible. To provide you with this capability, communications consoles allow selection of frequencies and intercommunications modes between your position and other operating positions.

Continued on next page

AN/FSA-58 communication console

The AN/FSA-58 has many desirable features. The modular characteristics of this system permit a virtually unlimited expansion of the basic equipment without undue installation of additional units.

Some of the features of this communication equipment are as follows:

- The modules may be mounted either vertically or horizontally on the console.
- There are no limitations as to the number of transmit or receive circuits for radiophone channels.
- Interphone circuits are available between controllers and between the supervisor and controllers.
- The supervisor's console contains a power and fault alarm system that gives both a visual and aural signal when trouble occurs within the system.
- The backup power supply automatically shifts to batteries or a standby power source in the event of primary power failure.
- An individual speaker and volume control is at each control position.
- An override feature is on the supervisor's console.
- Landline circuits may be patched into the modules.

The AN/FSA-58 is adaptable for use in either the control tower or a radar control room.

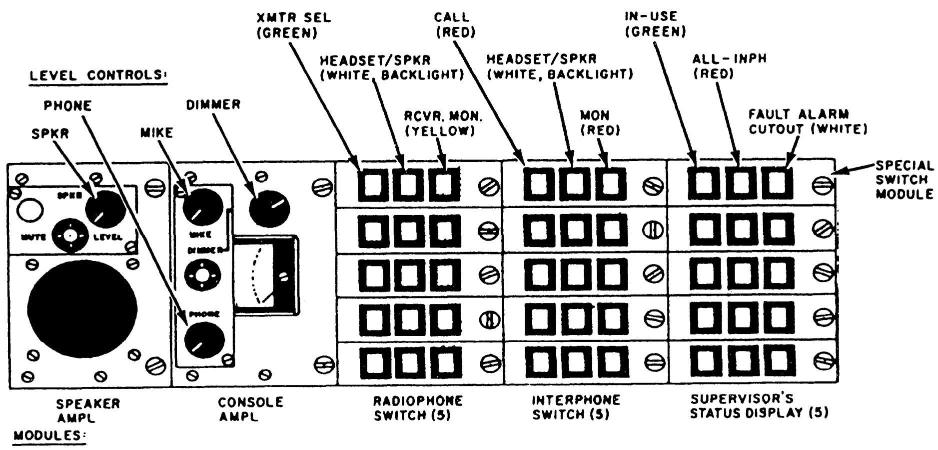
A controllers position normally consists of at least four modules each with a speaker amplifier, console amplifier, radiophone (TX/RX) switch, and an interphone switch. Additional (TX/RX) modules are installed as required.

All push buttons on the console are the lighted, transparent, colored lens type with provisions for identifying frequency, channel number, position, and so forth. A dimmer switch on the console amplifier controls the intensity of these lights.

Continued on next page

AN/FSA-58 supervisor's console

The supervisor's console has the same controls as the controller's console. In addition, the supervisor can determine from his or her console which controller is using a particular frequency and what channels the controller has been programmed for. The supervisor can also call all controllers simultaneously on the inter-phone from his or her console.



RADIO ONLY and RADIO-TELCO

A jack box is used in conjunction with the AN/FSA-58 communication equipment. It has two jacks for the headset, one marked "RADIO ONLY" and the other marked "RADIO-TELCO". For operation without landlines installed in the system, the headset would be plugged into the "RADIO ONLY" jack. When landlines are wired into the console and a controller requires access to them and the normal radiophone channels, the headset would be plugged into the "RADIO-TELCO" jack. The jack box is equipped with a switch that allows the controller to change between radiophone and landline circuits. A red lamp located on the jack box unit glows when the switch is in the "TELCO" position. With the switch in the "RADIO" position, received transmissions are heard in the headset. Received transmissions are transferred to the speaker when the switch is placed in the "TELCO" position.

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Integrated voice communication switching system (IVCSS)

IVCSS is a digital non-blocking 480-channel microprocessor-controlled ATC communications switching network. Operators have access to multiple radiophone, interphone, and landline channels in any combination as programmed by their supervisors. Other software features include manual ring capability, instructor mode, call forwarding, call transfer, remote door release, speed dialing, split operation, and access to multiple conference nets.

Operator positions are of conventional pushbutton design with a dual-tone multi-frequency (DTMF) keypad that replaces the conventional dial unit. All position equipment is modular in design and split operation speaker modules are optional for all operator positions.

IVCSS supervisor and maintenance positions

Supervisor and maintenance positions do not have conventional pushbuttons. Instead these positions have an interactive touchscreen with menu-driven access to all radiophone, interphone, and landline channels. In addition to menu-driven touchscreens, these positions have an interactive terminal and computer keyboard that gives access to the system's configuration control, diagnostic and traffic data collection menus. From these terminals, the supervisor or maintenance technician can assign or change position capabilities and features, check diagnostic alarms, or view historical use data for a particular channel or position during the last 24 hours.

All positions have common speaker modules, jackboxes, footswitches, and handsets or headsets.

NOTE: Control tower positions are identical to standard operator positions except that the direct access (DA) modules and special function modules are designed for sunlit working spaces. For this reason tower DA and special function modules are not interchangeable with regular position modules.

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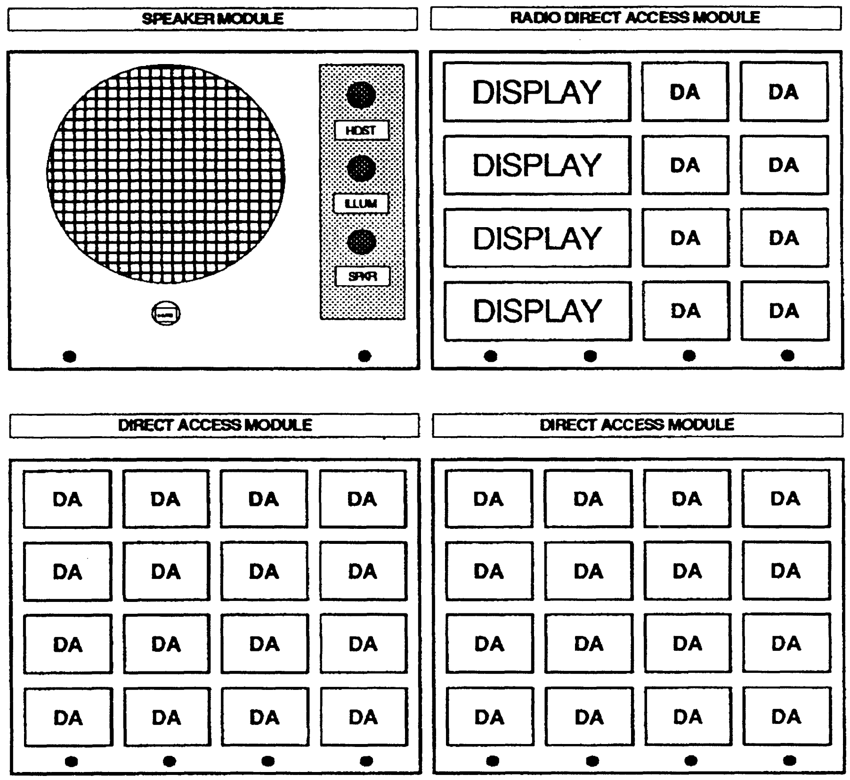
IVCSS operator console

The following figure is a sample IVCSS operator console:



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Enhanced terminal voice switch (ETVS)

ETVS contains centralized communications switching equipment (central switch). Supervisory and maintenance personnel use configuration terminals to configure the switch via a computer. Supervisors, at the supervisory configuration terminal, can reconfigure the switch for radio frequency availability, landline connections, and functions for each operator position. The switch also supports remotely located configuration terminals and operator positions.

Operator position equipment is linked to the switch. Operators select and switch communications channels by using touch entry devices (TEDs) or hard key panels.

ETVS jacks

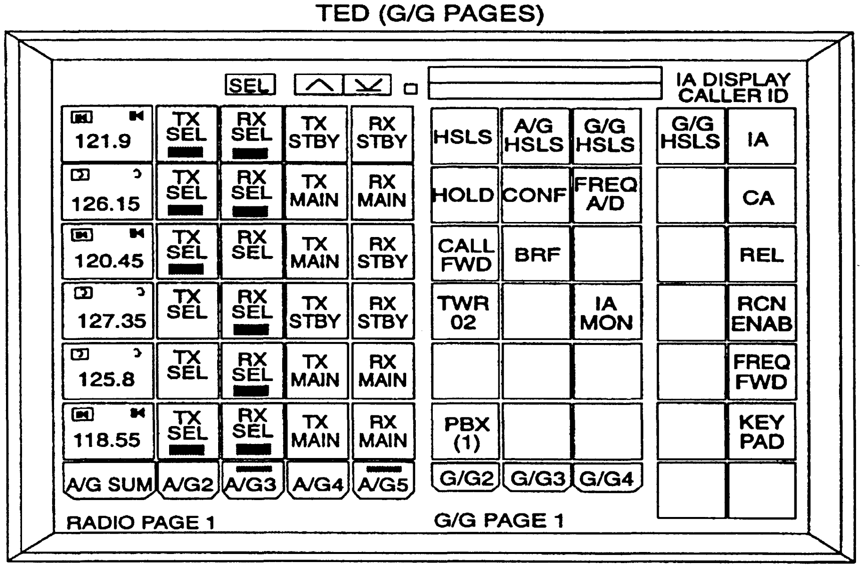
Two jacks at each position accommodate a trainee and an instructor headset or handset. The instructor uses the instructor jack to listen to the trainee's incoming and outgoing radio, telephone, and intercom audio. The instructor also can preempt the trainee; however, the trainee will still hear the instructor's communications.

Continued on next page

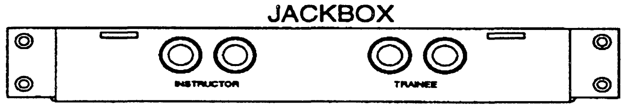
ETVS TED

A TED is an interface device with a resistive touch-sensitive membrane. The user selects pages by touching the membrane. Each page displays a matrix of selector keys pre-programmed for specific functions. One set of pages is used for radio communications control and another for telephone and intercom communications control. The touch keys display icons and color bars to provide key status indications. The color bars flash at different cadences to indicate operational status of each communications circuit.

TED (G/G PAGES)



JACKBOX



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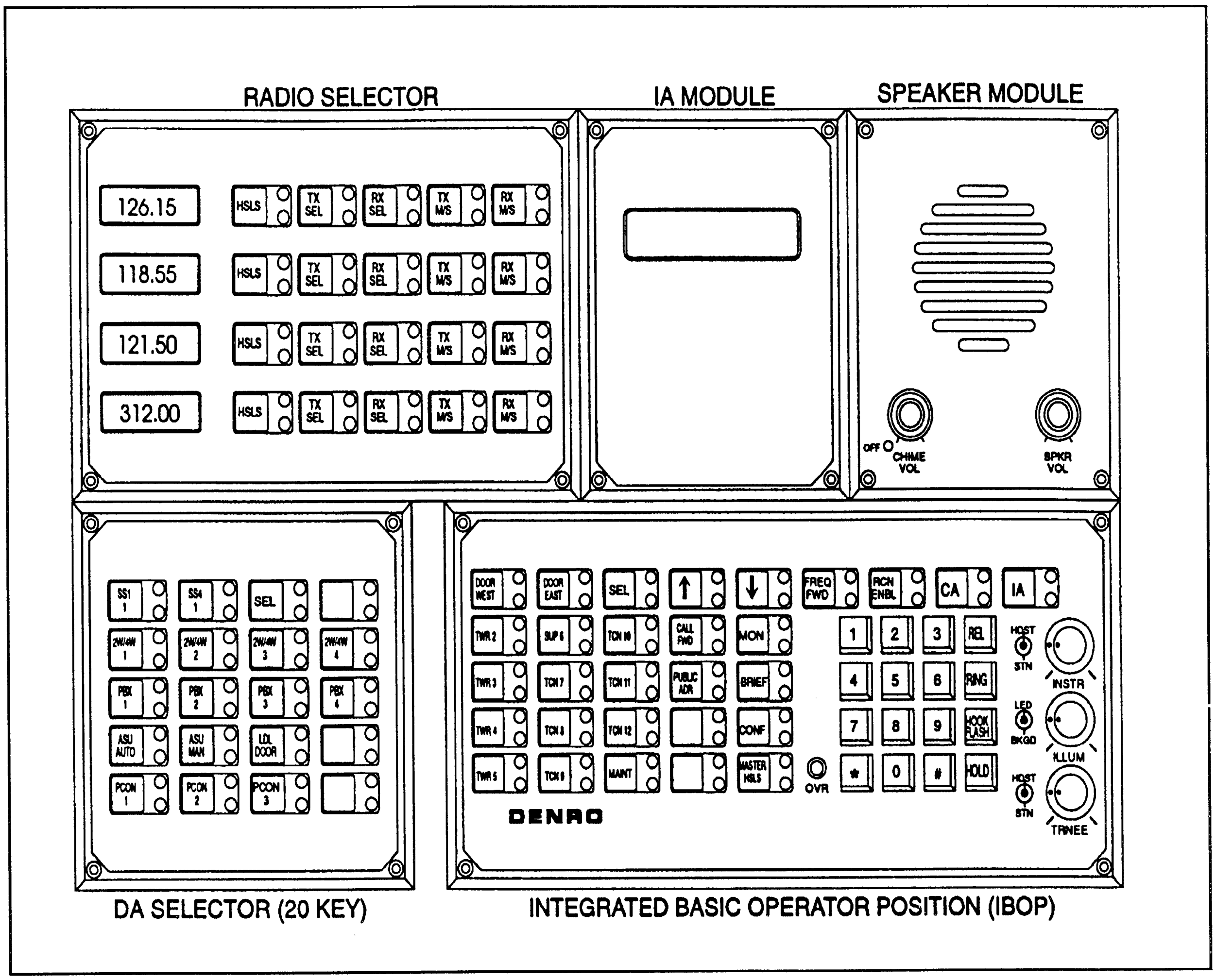
ETVS hardkey positions

The hardkey positions is mechanically more reliable than TEDs and provides a sealed panel surface. Two types of panels exist:

- Integrated Basic Operator Position (IBOP) panel—houses the position electronics
- Mini-Basic Operator Position (MBOP) panel—one that uses a position card file, similar to the TED card file, houses the electronics. MBOP is smaller and takes up less console space than the IBOP.



Microphones

Introduction

A microphone converts sound energy into corresponding electrical energy. When you speak into a microphone, the audio pressure waves from your voice strike the diaphragm of the microphone and cause the diaphragm to move in and out. The diaphragm is attached to a device that causes current to flow in proportion to the pressure applied to the diaphragm.

Types and techniques

There are two types of microphones in use today by ATC facilities—the hand-held type and the headset type. The headset type is considered the easiest and best to use. Most hand-held microphones are relatively inefficient, and the slightest variation of microphone position can drastically reduce the intelligibility of the message being transmitted.

Proper microphone technique is important in radiotelephone communications. Transmissions should be concise and in a normal conversational tone. Consider the following suggestions for proper technique:

- Speak clearly and distinctly.
- Avoid extremes of voice pitch.
- Be natural.
- Use standard phraseologies to the maximum extent practical, but do not be afraid to use plain language where no precedence has been set.
- Shield your mike from outside noises.
- Keep your mike a sufficient distance from an associated speaker to avoid acoustical feedback.

In radiotelephone communications, the operator of the equipment becomes part of the system. Along with the power and efficiency of the equipment, the manner in which the message is delivered determines the effectiveness of the transmitted signal.

Voice Recorders and Reproducers

Introduction

Recorders in ATC facilities record conversations between controllers and aircraft. These recordings are used for aircraft accident analysis; checks on circuit discipline; analyzing adequacy and accuracy of ATC instructions; immediate playback for assistance in search and rescue; and for voice training of ATC personnel. The most commonly used recorder at Navy ATC facilities is the RD-379(V)/UNH.

NATOPS Air Traffic Control Facilities Manual, NAVAIR 00-80T-114, charges the electronics maintenance division with the maintenance and custody of recorders and tapes. However, you may be assigned to make a written transcript or a rerecording of an original recording.

Voice recorder/ reproducer RD-379(V)/ UNH

The RD-379(V)/UNH is an audio-frequency, solid-state, magnetic-tape recording system that can make simultaneous recordings of up to 10 channels of audio information. These channels may be either different frequencies or different operating positions. Information stored on the tape may be played back through the reproducer head at the recording site, or the tape may be removed and played back on the separate reproducer RP-214(V)/UN.

The unit contains two identical tape transport assemblies, one of which is always kept in a standby condition. A fail-safe control tone is continuously recorded and reproduced at a level well below that of the desired voice recording. If the reproduce head fails to pick up this signal (such as, when the tape breaks), recording is automatically switched from the operating transport to the standby transport. When this happens, a loud audio alarm activates at the recording site. This alarm can be extinguished only at the recording site, thus allowing the cause of the alarm to be corrected immediately.

A shorting tap generates a control signal when most of the tape has been used. This signal switches the recording from the used-up transport to the standby transport. Although these tapes do not need to be erased before reuse, erasing (demagnetizing) will improve the quality of the new recordings.

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Voice recorder/ reproducer RD-379(V)/ UHN (continued)

Any one of the 10 channels can be individually monitored on either of the two transports. A rotary switch allows the operator to monitor either the incoming signal or the reproduced signal (which occurs approximately 4 seconds after the recording is made).

As previously stated, up to 10 channels of data may be recorded. It is normal practice, however, to use one of these channels to record an audio time announcement. This recorded time signal is displayed in DAYS-HOURS-MINUTES-SECONDS.

Voice reproducer RP-214(V)UN

The magnetic tape voice reproducer is a portable, audio-frequency, solid-state, magnetic tape reproducing machine with a 10-channel capability. This unit is able to reproduce any three channels simultaneously and monitor them on a loudspeaker or headset. Fast-forward and rewind speed enables cuing and searching for specific parts of the recorded tape. Searching for a portion of recorded information is easy. You need only know the time that the incident happened and search for it by using the recorded time announcement displayed in the window located at the top of the reproducer.

Labeling recorder tapes

Each tape reel must be labeled before storage with recorder identification and date of recording. Recorder tapes must be available to ATCF supervisory personnel.

Mishap recordings may not be released without consent of the commanding officer. A chain of custody with appropriate signatures obtained, indicating release and assumption of responsibility, must be established for all original voice or video recordings before the recordings are released to authorized agencies or officials.

NAVAID Monitors

Introduction

A malfunction of NAVAID equipment could place a pilot in a critical position; therefore, some automatic means must be provided for continuously checking a NAVAID system. This is done by electronic NAVAID monitoring devices that are sometimes located in the tower.

NAVAID monitors

Most monitor equipment is similar in that it provides both a light and an aural alarm to indicate that a particular NAVAID is malfunctioning. Some monitor equipment provides for an automatic changeover to standby NAVAID equipment when the main system has failed. Other equipment requires that the standby equipment be "dialed" on, which is a method similar to dialing a telephone with certain codes being dialed for certain functions.

When an alarm system of a NAVAID monitoring device goes off, you should get nonautomatic standby equipment into operation. Whether the equipment has changeover features or not, you should then notify the technician responsible for maintenance of the NAVAID equipment to provide for rapid repairs.

If the NAVAID has to be shut down or is unreliable, you should immediately notify the appropriate persons or facilities, which are determined locally. These authorities generally include the duty officer, the associated approach control, if not located in the tower, airborne aircraft, and the ARTCC in whose area of responsibility the station is located.

Where an indication of NAVAID status is required at positions other than at the primary (remote) monitor, an additional indicator may be installed to provide a slave indication from the primary (remote) monitor.

Visual Communications

Introduction

Visual communications (VISCOM) is installed in virtually all Navy control towers. VISCOM is one means used to coordinate between the radar controller and the local controller.

VISCOM

VISCOM (FSA-97) uses push-buttons and a sequence of lights and associated aural signals to supplement interphone circuits and to reduce the number of voice contacts between the tower and radar controller. The following description shows how VISCOM can be used at a typical radar and tower facility. Keep in mind that your facility may have different procedures and that the system does not replace all voice coordination.

Example of VISCOM

Light Color	Meaning
White	The white light indicates that an aircraft has entered the ATC system and is receiving radar service, or is on a downwind or base leg, or is 15 miles out on a straight-in approach.
Amber	The amber light indicates that the aircraft has reached a point 6 miles from touchdown or the end of the runway, and clearance is requested to 3 miles.
Green	The green light indicates that the aircraft is approaching 3 miles from touchdown or end of runway, and clearance is requested for landing, touch-and-go, or low approach, as applicable. The tower controller clears the aircraft by activating the green light switch, causing the light to become steady in both facilities.
Red	The red light indicates that the aircraft is to discontinue approach to the runway. The tower controller activates the red light by depressing the button, causing the light to flash in both facilities, and furnishes the reason for denying or canceling the clearance.

Section C
Control Tower Equipment

Overview

Introduction

At any location where terminal air traffic control (ATC) operations are conducted, the control tower is the hub of the ATC complex. From this hub, all clearances for landings and takeoffs originate even though the aircraft may be under the direct control of a radar approach control or ground controlled approach (GCA) facility. The tower local controller provides final clearance for runway usage. As new methods and equipment are installed at duty stations, every air traffic controller should study diligently not only the method of operation but also the capabilities and limitations of the equipment and the techniques used.

In this section

This section covers the following topics:

Airfield Lighting Control System

Introduction

The Airfield lighting control system (AFLCS) (AN/FSN-7) provides for remote control of airfield lighting circuits from control towers. The airfield lighting can be energized either from the tower cab or a remote site (lighting vault).

AFLCS description

AFLCS interfaces with electrical switchgear at various locations on an airfield to provide ON or OFF and intensity control functions for airfield lighting systems. AFLCS consists of two major groups:

- **Tower control equipment (TCE)**—located in the control tower and displays the status of the airfield lighting systems on a color monitor. The TCE also responds to operator control inputs by sending coded commands to various remote control equipment (RCE) distributed around the airfield.
- **Remote control equipment (RCE)**—responds to commands from the TCE by changing the status of certain airfield lighting circuits and reporting the new status back to the TCE for display.

AFLCS modes of operation

The AFLCS has two operating modes:

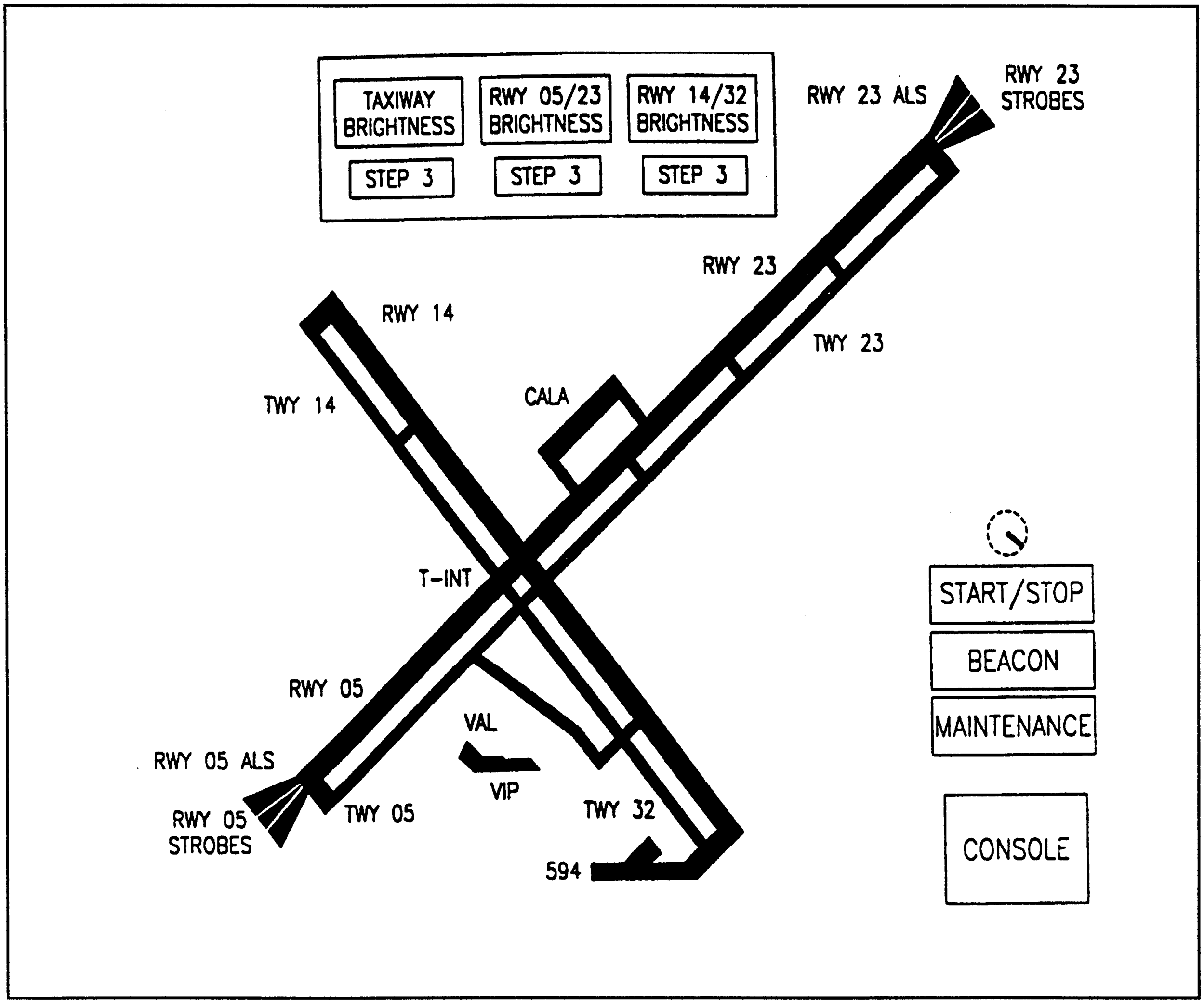
- Tower control mode—in this position, the operator can directly control airfield lighting from the tower cab
- Local control mode—in this position, the tower/local toggle switch disables tower control of the switches for maintenance purposes.

The control mode is determined by the position of a tower/local toggle switch located on each vault control unit. The AFLCS is normally operated in the tower control mode.

Continued on next page

AFLCS map window

The following figure is a typical AFLCS map window:



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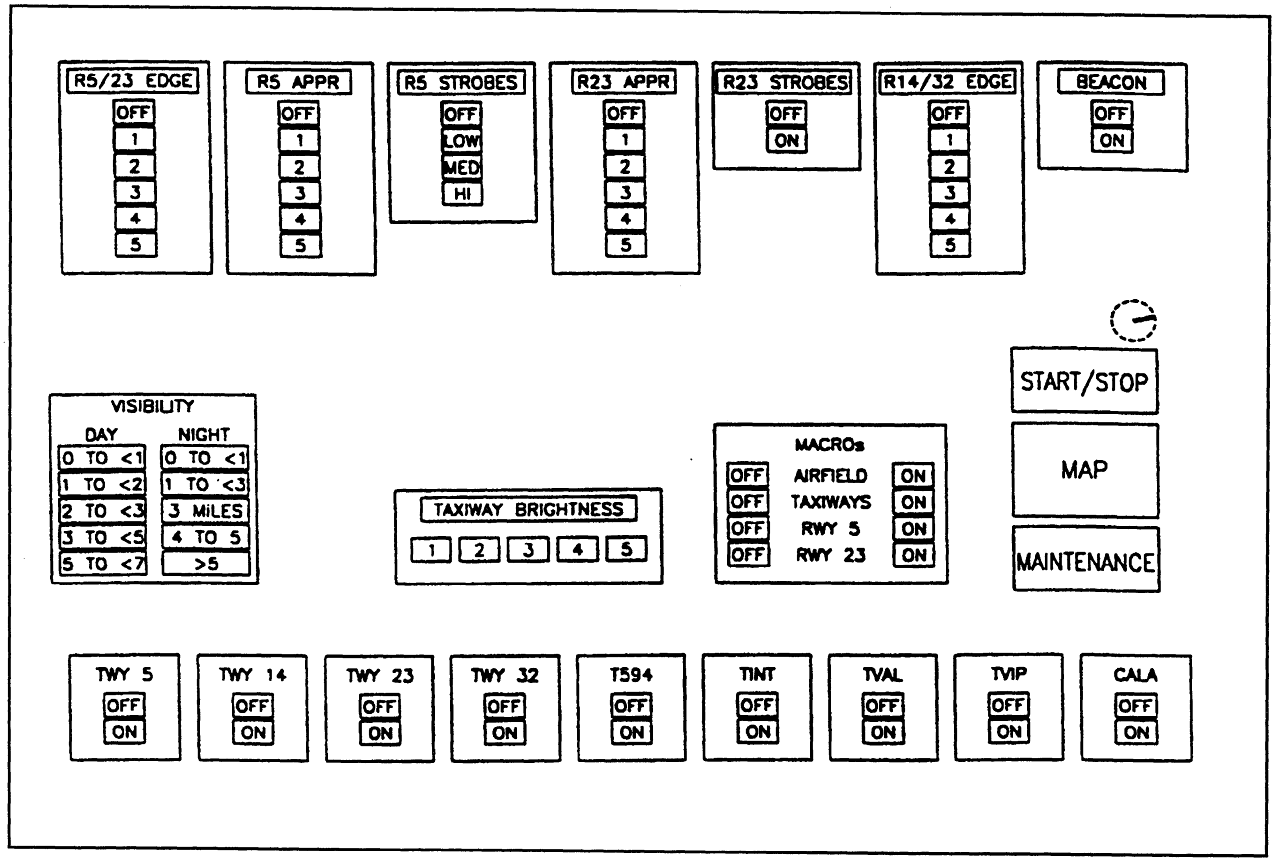
AFLCS console window

The following figure is a typical AFLCS console window:



Air Traffic Activity Analyzer

Introduction

ATCF must collect data for AICUZ analysis and the annual Air Activity Report. The Air Traffic Activity Analyzer aids in this data collection. A brief description of the analyzer will be provided in this section; however, the controller should refer to the technical manual for in-depth analyzer operating procedures.

Air traffic activity analyzer description

The air traffic activity analyzer is a Windows-based operating system consisting of macros arranged on up to six pages with 15 macros per page. These different macros enable the controller to select a variety of different aircraft operations.

Main window

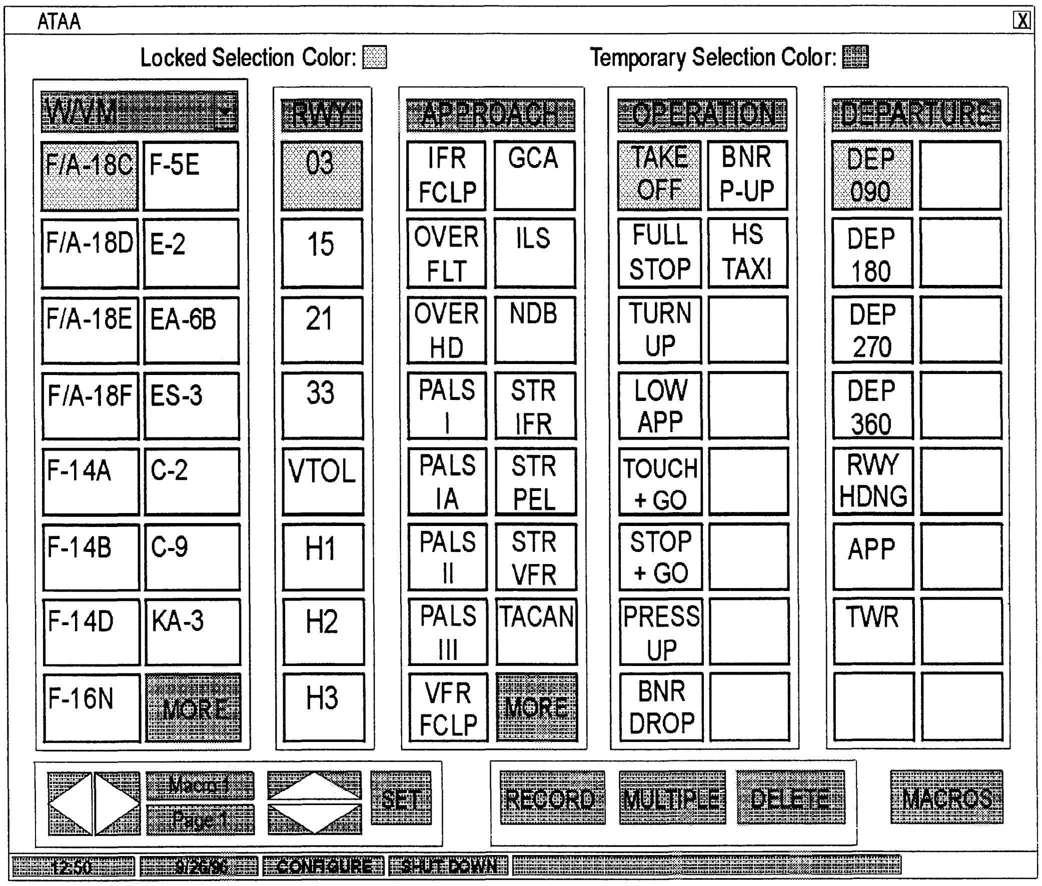
The main window enables the controller to select the owner, type aircraft, runway, approach, operation, and departure associated with an air traffic event. The major control groups are listed in the following table:

Control Group	Function
Aircraft selection	Selection of the owner and type aircraft
Runway selection	Selection of the runway
Approach selection	Selection of the approach
Operation selection	Selection of the operation
Departure selection	Selection of the departure
Database	Record and deletion of air traffic operations
Macro	Set and recall macro settings

Continued on next page

Main window example

The figure below is a sample of a main window of an air traffic activity analyzer.



ATAA

Portable Traffic Control Light

Introduction

The portable traffic control light is sometimes used to control the movement of personnel and vehicles on the landing area as well as the landings and takeoffs of aircraft experiencing radio difficulties or not equipped with a radio. It is a directive light that emits an intense, narrow beam. Signals from the light can be clearly seen by the pilot of aircraft visible to the tower operator.

Portable traffic control light operation

The portable traffic control light most commonly used has a mica composition case, a reflector mounted inside at the back, a mechanism for controlling a choice of three different colored lights, and a socket for a light bulb. The light selector consists of two filters, one red and one green, mounted vertically on two arms that extend into a horizontal position from the front to the back. These arms are connected to the light selector handle underneath the case, thus enabling you to select the appropriate color. Also, the selector handle aids in aiming the light. By turning this handle fully clockwise, you put the red filter in place, giving a red light; turning the handle fully counterclockwise puts the green filter in place, giving a green light.

The intermediate position, in which neither filter is in place (both at the side of the case), produces the clear or white light. The switch that controls the light is in a pistol-type grip located toward the rear of the light, underneath the case. It has a spring-loaded toggle switch that automatically opens the circuit when released. This feature enables you to flash the selected color or to hold the toggle switch down when a steady color is desired. The portable traffic light is normally installed in control towers from the overhead by means of a cable on pulleys and counterbalanced by weights. This feature keeps the light within reach for your instant use and in an out-of-the-way position when not in use.

Continued on next page

Capabilities and limitations of the control light

You should be thoroughly familiar with the limitations of the traffic control light and evaluate its capabilities when you anticipate its use. The traffic control light has the following advantages and disadvantages:

Advantages	Disadvantages
Requires no radio equipment in the aircraft; therefore, all aircraft can be controlled whether or not they possess a radio	The pilot may not be looking at the control tower at the time a signal is given.
Provides an emergency method of control in event of radio failure-either in the tower or the aircraft	The information transmitted by a light signal is limited. You may transmit only an approval or disapproval of the pilot's anticipated actions since no explanatory or supplementary information can be transmitted.

Use of control light

You should not hesitate to use light signals to control traffic, but you must be careful when using the light gun. You must transmit signals in a deliberate manner so the pilot will know the exact nature of the message. For instance, if the pilot were to start across the runway and you give a fast flashing green light, it might, on occasion, appear as a steady green light. The pilot in that situation would think that you were giving a takeoff clearance instead of a taxi clearance. The result would be a conflict with other traffic on the crossing runway.

Indoctrination courses and local rules that minimize vehicle traffic on aircraft movement areas are established at all ATC facilities. But since vehicular traffic is sometimes necessary, light signals may be used for controlling vehicles when the control tower has a radio outage.

Continued on next page

Control light signals

Besides the operation and limitations of the portable traffic light, you must know the meaning of the traffic control light signals used. You can find the signals to use for aircraft, vehicles, and personnel on the ground as well as the signals to use for aircraft in the air in either the *Aeronautical Information Manual* or *Air Traffic Control,* FAA Order 7110.65.

Portable traffic control light flight inspection procedures

Flight inspection procedures for portable traffic control lights are established for both the ground and the air.

- Ground—ensure adequate coverage for operational control of ground traffic
- Air—three miles in all quadrants at the lowest traffic pattern altitude

Tower Radar Display

Introduction

The volume of traffic in the terminal area requires the use of tower radar to augment visual control of traffic in the vicinity of major airports. Factors that contribute directly to the requirement are varying visibility conditions, a wide range of approach speeds, and larger airport landing areas.

The first radar designed specifically for use in the control tower was the Bright Radar Indicator Tower Equipment, Model 2. This system is commonly referred to as BRITE-2, a term derived from the initial letters of the noun name and the model number.

The BRANDS replaced the BRITE-2 in Navy control towers. Whereas BRITE-2 required a TV camera to relay radar information to the tower, BRANDS interfaces directly with the surveillance radar and the TPX-42 DAIR system. When properly used, tower radar systems reduce sequencing and traffic-flow problems and give you an earlier, more accurate look at developing traffic situations. By providing you with the exact location of your traffic, tower radar indicators enable you to sequence traffic accurately.

Basic principles of operation

The BRANDS displays the transponder code, altitude, and position symbol for each target, in addition to the primary radar return. Each BRANDS consists of one video indicator, an operational control box, and a TPX-42 indicator control box (A box) located in the tower cab; and one video indicator, operational control box, and an A box located in the maintenance room.

Many TPX-42 system features are included in the BRANDS. Target data blocks are displayed using the TPX-42 format. An option remains to display all targets, selected targets, or only those targets within selected altitude limits. The range, sweep offset, range mark spacing, and character size of data blocks may be modified.

Continued on next page

BRANDS features

Several new features have also been added to the BRANDS. When the radar site is not located on the airfield, another location within 10 miles of the radar site can be permanently offset as the center of the indicator. Five internal BRANDS video maps, customized for each ATC facility, can be used separately or in conjunction with the FA-8970 video mapper. The bearing and range readout is displayed on the indicator when the cursor and strobe are used. The decay rate of primary radar video may be modified to the desirable level.

Use of tower radar

The primary purpose of the tower radar display is to increase efficiency and safety of flight in Class C, D, and E surface areas. Tower radar supplements visual reference by correlating radar targets to visually observed aircraft and the known reported pilot position. Tower radar also serves as an aid in sequencing aircraft. Radar traffic advisories may be provided to an aircraft under tower control. When the VISCOM system and tower radar are used together, the radar gives the local controller a quick check of radar traffic when coordination is effected.

Besides the services listed above, the use of tower radar may be expanded to include radar separation and vectoring. Tower radar displays may be used to ensure separation between successive departures, between arrivals and departures, and between overflights and departures within the surface area for which the tower has responsibility provided the provisions set forth in *Facility Management,* FAA Order 7210.3 are met.

Daily equipment checks must ensure BRANDS accuracy and proper display alignment.

Video Information Distribution System

Introduction

A new system scheduled for installation at naval air stations is the Video Information Distribution System (VIDS). This system is designed to consolidate, replace, and automate several ATC systems.

VIDS consolidated systems

VIDS will consolidate the processing, control, and display of the information from the following systems:

- Master Wind Speed and Direction Indictor (WSDI)
- Digital Altimeter Setting Indicator (DASI)
- Airfield Lighting Control System (AFLCS)
- Automatic Terminal Information Service (ATIS)
- Facility Time Code Generator (TCG)
- Automated Surface Observation System (ASOS)
- Weather vision
- Flight Data Input/Output (FDIO) System
- Remote video cameras

VIDS replacement systems

VIDS will replace the following system components in the control tower:

- Slave WSDIs
- DASI displays
- ATIS systems
- Clock displays
- Weather vision displays
- FDIO remote control units, displays, keyboards, and printers
- Remote video camera displays and controls
- AFLCS

VIDS automated systems

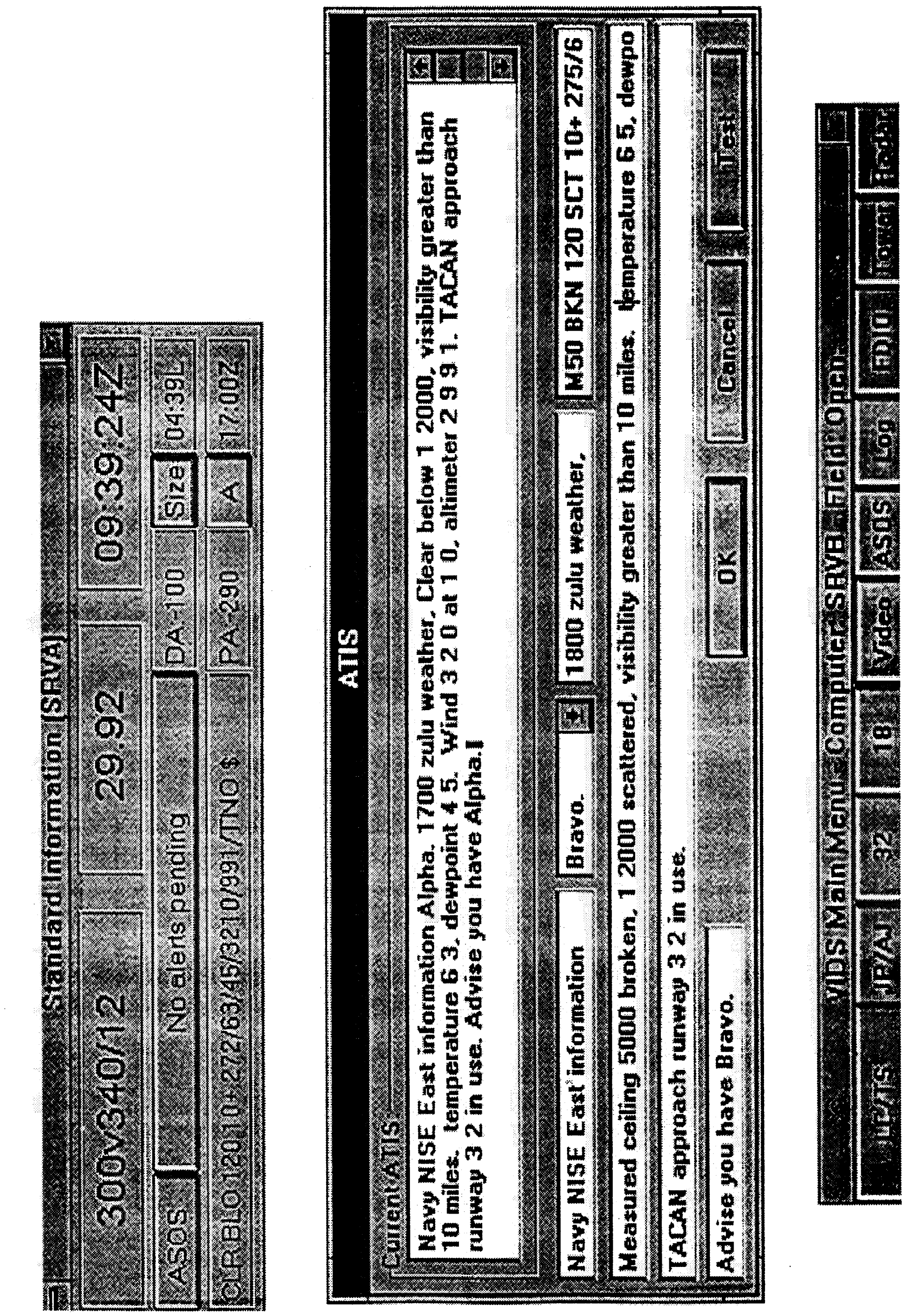
VIDS will automate the following control tower administrative functions using a centralized database:

- Daily operations logs
- Position logs

Continued on next page

Video Information Distribution System, Continued

VIDS window The following is an example of an VIDS ATIS edit window:



General Equipment

Introduction

Besides the equipments we have discussed, each Navy control tower is provided the equipment, logs, and diagrams or status boards, as needed, to meet operational requirements.

Equipment

The following is a list of control tower equipment, logs, and diagrams or status boards that are normally available:

- Weather vision or other display device used to update weather conditions
- Emergency communications equipment such as the crash alarm system
- Binoculars (at least one pair of 7x50 power or stronger)
- Airfield lighting and visual landing aids controls
- Air traffic activity analyzers for recording the number of aircraft operations
- Waveoff (wheels up) lights control
- Wind speed and direction indicator
- Altimeter setting indicator
- ATIS
- Tower log
- Position logs
- An airfield diagram and status board with the following information:

Runways with length and width	Arresting gear status
Taxiways with direction indicated if not bidirectional	NOTAM and non-NOTAM field conditions
Intersection takeoff information	Status of communications equipment
Arresting gear location and type	Outages
Location of navigational aids	Weather warnings
Radar equipment status	Visual landing aids
NAVAID status (unless NAVAID monitors are located in the control tower)	Other pertinent information

Section D
Radar Equipment

Overview

Introduction

The term *radar* is formed from the words **RA**dio **D**etection **A**nd **R**anging. Radar systems are integrated into the air traffic control system and are installed at almost all air stations throughout the Navy. In this section, we discuss radar as applied in air traffic control. It is an important tool of your trade.

In this section

This section covers the following topics:

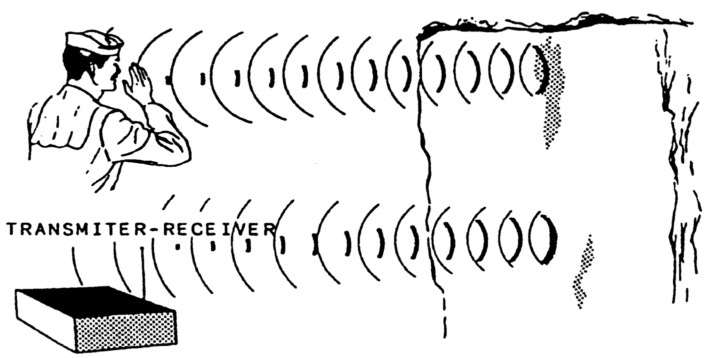
Fundamentals of Radar Operation

Introduction

Radar depends on the principle that energy emitted from one point and traveling at a uniform rate is reflected by obstructing surfaces in its path. In which case a small portion of the original energy returns, at the same rate of speed, to the point of origin.

Echo principle

If you shout in the direction of a cliff or some other sound-reflecting surface, you will hear an echo. The sound waves generated by your shout travel through the air until they strike the cliff. There they are reflected. They return to the originating spot, where you hear them as weak echoes. Time elapses between the instant your shout leaves and the instant you hear its echo. Because sound waves travel through air at a relatively slow rate (1,100 feet per second), you notice the time interval. The farther you are from the cliff, the longer this time interval will be. If you are 2,200 feet from the cliff when you shout, about 4 seconds will pass before you hear the echo. It takes 2 seconds for the sound waves to reach the cliff and 2 seconds for them to return.



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Echo principle (continued)

In radar, the shout of our sound analogy is a series of short signal pulses from an extremely high frequency transmitter that sends out high-power electromagnetic radio waves. Electromagnetic waves travel much faster than sound waves. The speed of radio energy is the same as that of light. An object in the path of these waves reflects some of the radio energy. The reflected energy, or echo signal, is picked up by the same antenna used by the transmitter and is fed to a receiver. The receiver amplifies the signal, changes it to a usable voltage, and feeds it to an indicator.

Distance and direction

The signal pulse is repeated at definite time intervals. There is a very short period during which the transmitter sends out energy. There is a much longer period during which the receiver waits to pick up the reflected signals. The farther away the object, the longer it takes for the energy to reach the target and return. When each echo is received, the time between transmission and return of the echo is measured electronically. Because we know the time it takes to receive a reflection from an object and the speed at which pulses of radio energy travel, we can calculate the distance to an object. Because the energy travels to and returns from an object in straight lines, we also know the target's direction.

Echo display

Radar uses hundreds of pulses per second and gets an indication of each reflected signal.

The antenna radiates the pulses and rotates and shapes the energy into a narrow beam. As the antenna slowly rotates, an illuminated sweep line from the center of the display to the outer edge moves around the display (called scanning). This sweep line is synchronized with the motion of the antenna. If there is no echo (no object in the path of the radar pulse), the sweep line is of uniform intensity on the face of the display. However, if a radar pulse is reflected, it causes the sweep line (or sweep) to momentarily brighten at the location of the echo. This process is repeated for each pulse sent out or returned.

Continued on next page

Echo display (continued)

Echoes from the same object repeatedly brighten the same area, thus making a steady spot of light. Since the rate at which the pulse travels is known, the sweep can be marked off to represent the distance the pulse travels in that length of time. These marks (range marks) assist in determining the echo's (target's) specific distance from the antenna.

The position of the spot of light (if there is a target echo) on the display shows both the direction (azimuth) and the distance (range) of the target. The greater the range of a radar set, the slower the antenna rotates. This allows more time for the reflected return of pulses to travel the greater distance.

NOTE: A term commonly used in the radar environment is *paints,* for example, as the radar antenna is rotating, the sweep *paints* an area on the display.

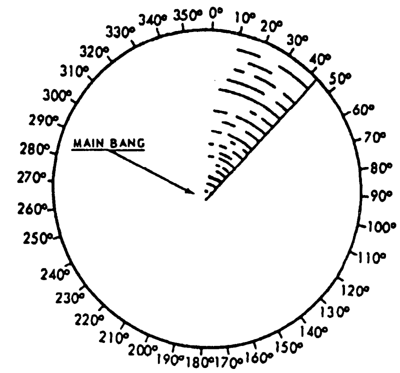
Radar Display

Introduction

There are numerous ways of displaying the radar data once it has been obtained. The manner of presentation depends upon the use to be made of the data.

Plan position indicator

In ATC, the most frequently used type of ASR display is a plan position indicator, commonly referred to as the PPI scope. In this type of radar search indicator, the time reference is at the center of the cathode-ray tube face. Bearing information is provided through the use of a compass rose. The compass rose is a circular device. It surrounds the PPI and depicts magnetic bearings from 0 to 350 degrees in 10-degree increments. The ASR has 360 degrees of scan.



PPI range information

Range information on a PPI scope is provided through the use of range marks. Range marks show up as bright concentric circles on the scope. Their spacing takes various values (1 mile, 5 miles, and so forth), although at any one time the spacing will be uniform throughout the display.

The PPI scope may be expanded for short ranges. For example, a 5-mile range may actually cover the same area on the face of the tube as a 30-mile range.

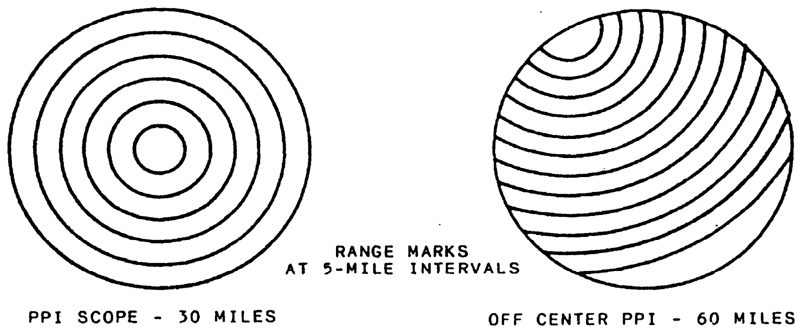
Off-centered PPI scope

When an aircraft makes radar approaches, you will often use an **off-centered** scope. By moving the placement of the antenna sight (the "main bang") on the radar scope, you will be able to see a greater area of airspace in one direction. At the same time, this diminishes the airspace area you will be able to view in the opposite direction.

Continued on next page

Off-centered PPI scope (continued)

For example, let's say that 30 miles is the greatest range on a range selector switch. It is possible to extend the sweep out to 60 miles in any desired sector by off-centering the main bang to the edge of the tube face. Whether targets could be seen out to 60 miles depends on the radar system itself and the type of target. The figure below shows two PPI scopes with the same range selected, but with one off-centered to increase the area covered to the southeast.



Remember that bearing and range information are relative to the main bang on the off-centered scope just as in a normal-centered presentation. It is very simple to obtain bearing information when you use the centered scope. In the center of the surrounding compass rose is the main bang. It may be used as a reference point until you become more familiar with bearing information. Because off-centering displaces the main bang from the center of the compass rose, imagine a 360-degree compass rose surrounding the main bang wherever you have placed it on the scope.

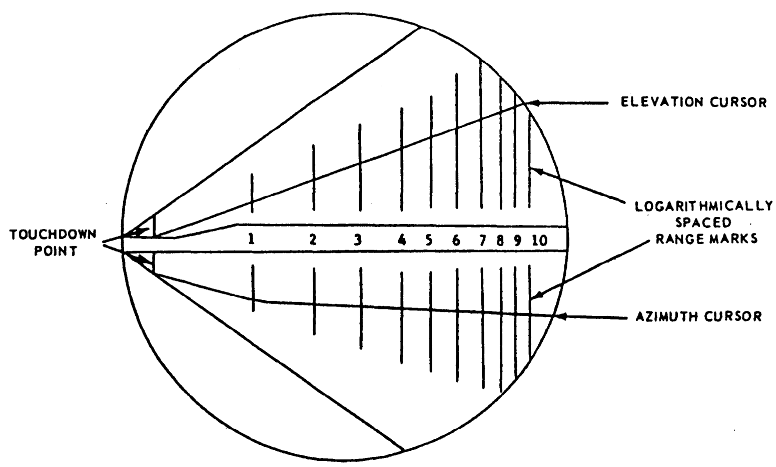
Angle marks and precision approach radar

Besides range marks, some search radar indicators have angle marks. These angle marks are intensified lines that outline the sector scanned by precision approach radar antennas. These angle marks enable you to guide an incoming aircraft into the area served by the precision approach radar.

Continued on next page

Precision approach radar indicator

The precision approach radar indicator displays azimuth, elevation, and range information and enables the controller to closely observe aircraft position during the approach. The indicator used for this presentation is called the **AZ-EL indicator** for azimuth and elevation. The elevation presentation appears on the upper portion of the display, the azimuth on the lower portion. On the elevation portion, a bright line indicates the glidepath. On the azimuth portion, a bright line indicates the runway course line. The bright lines are commonly called **cursors.** In addition to these cursors, range marks are also electronically traced on the AZ-EL indicator. These range marks, occuring at 1-mile intervals, are spaced in logrithmic relationship. The first mile from touchdown on the display occupies a greater distance than the second mile, and so forth. This has the effect of expanding the display as the aircraft approaches the runway and provides the controller with increasingly precise indications of the aircraft's flightpath.



Functional checks

Before using your radar, you are required to complete functional checks on the equipment. Should you find any discrepancies, these must be brought to the attention of the supervisor. During your watch, traffic permitting, you should periodically check your alignment.

Radar, like other NAVAIDs, requires flight checks. Refer to *US. Standard Flight Inspection Manual,* NAVAIR 16-1-520, for types and requirements.

Special Circuits, Equipment, and Tolerances

Introduction

A basic PPI display shows all types of radar echoes—both fixed and moving targets. Ground targets normally displayed as strong echoes and weather echoes could mask echoes from aircraft flying over these areas. Any echo that is undesirable, or that prevents the controller from observing aircraft, is called *clutter*. Sometimes it is called *noise* because it is analogous to static of a radio receiver. When it comes from the ground, it may be called ground return; and when from the sea, sea return. Special circuits have been added to the basic radar components to eliminate or reduce clutter.

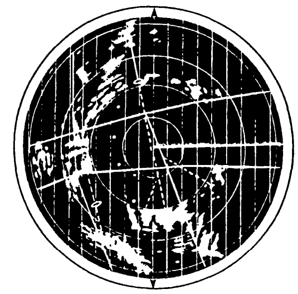
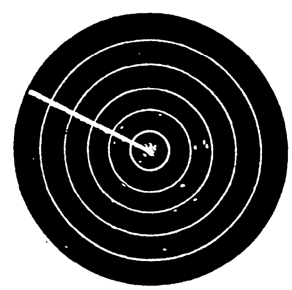
Special circuits

Many factors affect radar control. As an example, the amount of reflective surface of an aircraft determines the size of radar return. Remember there are limitations to radar service due to equipment limitations. The special circuits listed below are used to overcome equipment limitations.

Circuit	Function
Automatic frequency control	Not an adjustable circuit. Keeps the radar transmitter and receiver tuned to the same frequency. Adjusts for the effects of frequency drift. Without AFC, many echo signals are lost.
Fast time constant	FTC offsets the effects of heavy precipitation that tends to block aircraft targets. Displays only the leading edge of long-duration returns (precipitation) and allows small-target echos to get through without change.
Sensitivity time control	Assures that targets appear with equal intensity, regardless of range variation. It also prevents blooming of targets nearer the antenna. At the beginning of the sweep, where ground clutter has the most effect, STC makes the gain quite low to reduce the effects of the clutter.

Continued on next page

Special circuits *Table continued from page 5-D-8.*

Circuit	Function
Moving target indicator	Distinguishes between moving and stationary targets and blocks out the stationary targets. Disadvantage to MTI is blind speed (target disappearing at a certain speed), PRF eliminates blind speeds below approximately twice the speed of sound. The figure shows a 20-mile PPI display with MTI adjusted to 10 miles. 
Clutter-gated video	Automatically switches the radar system from MTI to normal and from normal to MTI for the best presentation.
Circular Polarization	Cancels returns from symmetrical targets, such as raindrops, while accepting returns from asymmetrical targets such as aircraft. CP will also reduce the target strength of aircraft targets and, in some cases, may eliminate them altogether.  Linear Polarization  Circular Polarization

Radar Mapping Systems

Introduction

A radar controller uses the range marks on the PPI and the compass rose around the edge of the scope to obtain the position of an aircraft target. Information from these two sources only gives range and azimuth from the radar antenna. It does not depict the geographical location of the aircraft; therefore, some type of map display would be helpful. Two types of mapping are available as integral parts of a PPI--a map overlay and video mapping.

Map overlay

The simplest form of mapping system is the map overlay. As the name implies, it is installed so that it covers the face of the CRT. The overlay is made of transparent plastic. It has etched into the surface necessary reference marks as well as the location of NAVAIDs, runways, and obstructions. The overlay is edge-lighted, and you can control the brilliance.

Map overlay drawbacks

There are two built-in disadvantages to the map overlay. Since the map is installed a short distance away from the tube, the targets do not appear in proper relation to the map unless you look at the target from a point directly above the target. When your viewing position changes, targets apparently drift away from one of the etched courses. This causes an error called parallax. You must be extremely careful of your posture so that you can observe the target correctly and prevent parallax. The other disadvantage is that the map is only good for one range setting of the radarscope since it does not expand with the display on the tube.

Video mapping

The video map is a great improvement over the map overlay. The video map is produced by a separate mapping unit. A scale map with the desired features is drawn and then reproduced as a round photographic negative. This information is fed to the video amplifier and then mixed with radar information from the receiver so that the resulting signals to the PPI contain a combination of radar and map data. The antenna scan and the map scan are synchronized so the map is developed directly on the PPI as the sweep progresses. The result, and biggest advantage of the video map, is that the map expands or contracts as the range of the indicator is changed. The map coverage is in direct proportion to the area covered and is accurate when the scope is off-centered.

Continued on next page

Video Mapping (continued)	Since the map is produced on the face of the tube along with the radar information, there is no parallax error. Thus, with a single map and mapping unit, a number of ranges with corresponding plotting information are available for display on several indicators operating independently of each other.
Video map drawbacks	The video map is subject to some drift. Slight errors resulting from drift can usually be corrected by a radar technician. Another disadvantage of the video map is the possibility of failure of the mapping unit, which results in no map on the PPI. You should refer to *Air Traffic Control,* FAA Order 7110.65, for procedures to be followed when radar mapping is not available.

Air Traffic Control Radar Beacon System

Introduction

Secondary surveillance radar is the term used for the ATC radar beacon system. This is in contrast to *primary radar* that was described during the earlier discussion of the echo principal. Secondary surveillance radar is a separate system and is capable of independent operation. In normal ATC use, secondary surveillance radar is slaved with ASR. A display of both the primary and secondary radar targets is presented on the associated PPI.

Functions

The functions of the ATC radar beacon are as follows:

- Reinforcement of radar target
- Rapid target identification
- Extension of radar coverage area (up to 200 miles)
- Transmission of altitude and other data

Components

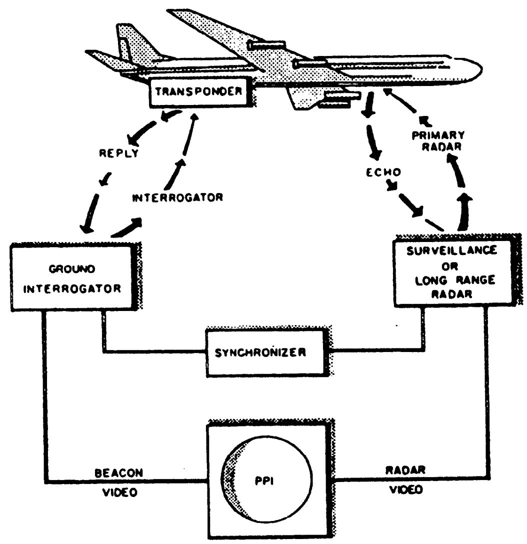
The components of the secondary surveillance radar are as follows:

- Interrogator on the ground
- Transponder in an aircraft
- Display on an ATC radarscope

Continued on next page

Components (continued)

When the word *radar* is used, it refers to a primary radar system. Primary radar differs from secondary surveillance radar in that primary radar displays reflected signals and does not display signals that have been transmitted by an airborne transponder. The two systems work together and are displayed on the scope at the same time.



Secondary surveillance radar advantages

Secondary surveillance radar effectively counteracts the following shortcomings of primary radar:

- The limiting effect of aircraft reflection areas that vary -with aircraft size and configuration
- Displays degraded by weather conditions, especially precipitation
- Impairment of the radar display by ground clutter even though the radar is equipped with MTI
- Blind spots in the antenna coverage pattern

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IFF/SIF

Identification Friend or Foe (IFF) electronically distinguishes between friendly and hostile aircraft. Selective Identification Feature (SIF) is a form of IFF that enables the IFF system to generate many variably coded replies.

Interrogator set

The Interrogator Set consists of a beacon-type IFF/SIF system and processing units that provide synthetic video for display on the radar PPI. It enhances the radar operator's PPI display by replacing the conventional IFF response from the aircraft with a target symbol that represents a variety of aircraft status conditions and with two sets of numbers that provide direct identification and altitude.

The targets are continuously refreshed to prevent target fade and to provide the operator with easy-to-read information. Target trail dots are available to portray course history and/or to provide an indication of ground speed. The operator selects the information display that he or she needs on the PPI. An aircraft emergency, hijack, or communications failure is automatically displayed in addition to the information displays that the operator selects.

Application modes

The IFF/SIF system is known as ATCRBS. The ATCRBS is capable of making interrogations in any four of the six different modes shown in the table below. Mode A is the civil and military air traffic control mode. Since civil mode A is the same as mode 3 in military equipment, this common air traffic control mode is called mode 3/A. Modes 1 and 2 are military tactical modes. Mode B is a civil air traffic control mode, but is not used in the United States. Mode C is used for automatic altitude transmissions. Mode D has been established, but its use has not been specified.

Mode	Application	Mode	Application
1	Military IFF	B	Civil (ATC)
2	Military IFF	C	Civil (Altitude)
3/A	Common (ATC)	D	Civil (unassigned)

Continued on next page

Direct altitude and identity readout system

Besides receiving altitude information from transponder-equipped aircraft, the DAIR equipment presents digitally derived synthetic display markers and numerical data blocks. These blocks do not fade from the scope as do primary radar targets. This data block displayed adjacent to the center mark (aircraft's actual position) consists of the assigned beacon code that the aircraft is squawking and the altitude at which the aircraft is flying. Altitude is indicated in 100-foot increments from MSL.

Altitude data is received through mode C interrogations to aircraft transponders. Interrogations can be filtered to display only aircraft targets within controller-selected altitude levels.

Traffic alert and collision avoidance system (TCAS)

TCAS is an airborne collision avoidance system based on radar beacon signals that operates independent of ground-based equipment. Currently, two versions exist:

- **TCAS I**—provides proximity warnings only to assist the pilot in the visual acquisition of conflicting aircraft. No recommended avoidance maneuvers are provided.
- **TCAS II**—provides traffic advisories and resolution advisories. Resolution advisories provide recommended maneuvers in a vertical direction (climb or descend only) to avoid conflicting traffic.

Radars

Introduction

In this section, we briefly describe radar equipment in general use. This information is not all-inclusive or a substitute for familiarity with the equipment in use at your facility. For more detailed information on the capabilities and operating controls of these systems, study the operator's section of the applicable technical manual.

GPN-27 radar (ASR-8)

The ASR-8 is a solid-state, airport surveillance radar system. It is used to detect primary radar aircraft targets within 60 miles of the antenna site. The system is reliable and easy to service. Except for the antenna, major assemblies are duplicated to provide dual-channel operation. If one channel fails, the operator can switch to the standby channel.

The ASR-8 is interfaced with the TPX-42 system. Also, the ASR-8 uses a staggered PRF to prevent the occurrence of blind speeds caused by MTI.

The ASR approach course line must coincide as nearly as feasible with the runway centerline extended. Maximum error left or right of the runway edges must not exceed 500 feet at a point 1 mile from the approach end of the runway.

FPN-63 radar

The FPN-63 PAR is a solid-state unit and can be mounted on a remotely controlled turntable. The coverage of the FPN-63 is 8 degrees in elevation and 20 degrees in azimuth. It allows either a 10- or 20-mile range selection. When MTI is used, the **RANGE SELECT** switch will choose either 10 or 15 miles. The 5-mile range marks on the AZ-EL scope are brighter than the others. There is also a **PAR minimums marker** on the elevation scan that marks the decision height (DH) for the runway in use.

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FPN-63 radar

The FPN-63 has a staggered PRF and an MTI velocity offset control. When echoes of bad weather or blocks of trees show on the scope, you may vary the MTI control to block their echoes.

On a PAR approach, the course deviation must not exceed 30 feet or 0.2 degree, whichever is greater, at the runway threshold. The range information given must be accurate within plus or minus 2 percent. Also, the PAR radar must be capable of detecting an aircraft on the runway centerline extended at an altitude of 2,000 feet and distance equal to the maximum range of the scope.

FACSFAC air control tracking system (FYK-17)

The FACTS is the basic system used to provide air traffic control of the Navy's operating areas (OPAREAS). FACTS is an automated control system which consists of computers, displays, computer programs, peripherals, and internal and external interfaces with associated systems.

FACTS provides a multicolor display. Each of the four colors (red, orange, yellow, and green) displays eight levels of intensity. These color differences enable the controller to delineate such things as weather, targets, aircraft, "hot areas," and other map data by vivid color.

The FACTS system accepts data from remote long-range and short-range surveillance radars. FACTS then processes and displays the radar data in various combinations of letters, numbers, symbols, and colors. The FACTS system also interfaces with the FAA National Airspace System Enroute Stage A, ARTS facilities, and the Advanced Combat Direction System (ACDS).

Radar Performance Characteristics

Introduction

When a radar system is developed that detects only flying aircraft and nothing else, the radar controller will have a nearly perfect system for controlling traffic. However, since the perfect radar system has yet to be developed, you need to be aware of the limitations of existing systems. Such limitations include target fades, anomalous propagation, false targets, jamming, and electronic interference.

Target fades

A property of all radar systems with which the controller should become thoroughly familiar is target fading. Target fades varies with the type of equipment, antenna height, tilt angle of the antenna, atmospheric conditions, and the surrounding terrain. Target fades are clear when an aircraft is over the antenna site. The degree and length of such a fade is determined by the amount of antenna tilt. The lower the tilt angle of the antenna, the better the low-angle coverage. Conversely, the higher the tilt angle of the antenna, the better the high-angle coverage. Most antennas are set to give maximum coverage for the particular type of control being employed.

The coverage in range, altitude, and azimuth for a particular site is determined by means of a flight inspection evaluation. An FAA flight inspection team conducts this evaluation before a facility is commissioned. When a previously unknown fade area is suspected, another flight inspection should be requested to verify or confirm its existence. The data obtained from the flight inspection gives the controller an indication of coverage and target fades built in the type of equipment being used. To understand the capabilities and limitations of the system, you should become thoroughly familiar with the coverage pattern and fade areas determined by the flight inspection. For further information and a detailed description of the procedures used when flight inspections are performed, refer to the *United States Standard Flight Inspection Manual,* NAVAIR 16-1-520, and *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

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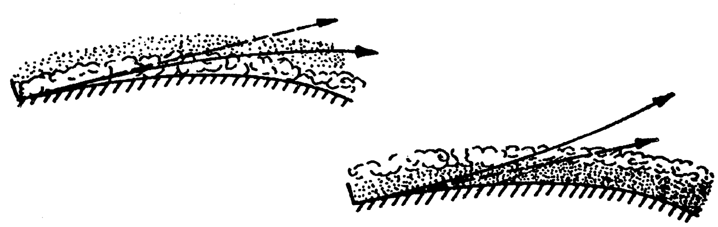
Anomalous propagation

The atmosphere surrounding earth is not uniform in density or moisture content. It is possible for local conditions to exist in which radar beams are bent upon passage through the atmosphere. Conditions under which the radar beam does not travel a straight line are called conditions of *anomalous propagation.* This condition is most apt to occur on days when there is little wind and when the air temperature is different from the ground temperature.

Anomalous propagation is most common over water where water evaporation causes a temperature and moisture gradient to exist. The refraction of dry or dense air is greater than that of moist or less dense air; therefore, radar beams are bent in the direction of the dry or dense layers. The figure depicts two conditions of anomalous propagation—the atmosphere causing a downward bending of radar beams and the atmosphere causing an upward bending of radar beams.



Because of anomalous propagation, targets hundreds of miles away may be detected even though they are far below the horizon. Conversely, relatively close targets may not be detected.

False targets

A proficient radar controller is quick to recognize a temperature inversion as a false target. Such indications are often secondary reflections of radar energy from isolated refracting areas in a temperature inversion level. Correlation of radar reports with the National Weather Service records indicates that a temperature inversion is usually present when unidentified flying objects appear on the scope. These inversions often travel across the radar at tremendous speeds and in changing directions. Apparently this phenomenon is produced by isolated refracting areas traveling with the wind

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False targets (continued)

at or near temperature inversion levels. The exact size, shape, and composition of these isolated areas is not known. It is believed that they may be atmospheric eddies produced by a shearing action of dissimilar air strata. It appears that such eddies may reflect and focus the radar energy with a lens effect. This produces a small concentration of ground return with sufficient strength to show up on the radar display.

Radar jamming

Jamming, as used in conjunction with radar, is defined as an introduction of false radiation into radar and radar devices. False targets produced by jamming may appear on the scope at varying ranges and bearings. In some cases, they may clutter large portions of the scope.

Jamming is classified as two main categories--active and passive. Active jammers are those which generate radar energy, producing interference. Passive jammers are those that act as parasitic radiators, such as chaff. Chaff is thin strips of aluminum or other metal cut to a particular length. When released from aircraft at high altitudes, the strips float down to the ground slowly. The resultant echoes cause large areas of clutter.

Controlled jamming is conducted by the military and regulated by the FAA to preclude interference with air traffic control radar. When prior notification has not been received, controllers observing jamming operations should notify the appropriate authority. Procedures are described in *Air Traffic Control,* FAA Order 7110.65.

Electronic radar interference

Interference from other radar installations that operate on a similar frequency may be encountered when two or more radar installations are in close proximity. When this interference is encountered, nearby radar installations should be advised to check the frequency calibration of their equipment.

Most radar installations have dual channels so that a standby channel is always available. At times, the standby channel transmits a signal that produces interference. In most cases, fine tuning of the equipment by the technician decreases the amount of interference.

Section E
Shipboard Equipment

Overview

Introduction

The equipment that you will use to perform your duties in CCA is, in some cases, very different from what you find at a shore facility. Training in CCA on an operator's position includes equipment operation and control procedures. As we discussed in previous sections, your equipment is essential to your job. Providing safe control depends on your knowing how to operate the equipment and to monitor it to make sure it operates correctly.

In this section

This section covers the following topics:

Search Radar

Introduction Most aircraft carriers have a variety of air-search radars on board.

Search radars Some air-search radars are long-range (up to 240 miles); others are medium-range (50 to 60 miles). Sometimes, CDC and CCA share the use of shipboard radars; CDC for air tracking, air intercept, and surface tracking; and CCA for air traffic control.

Shipboard air search radars have IFF/SIF radar beacon systems that provide the same capabilities as the ATCRBS/DAIR equipment used ashore. This equipment is referred to as CATCC/DAIR.

The obvious difference between radars used on board ships and radars used ashore is that shipboard radars are on a continuously moving airfield. For this reason, most shipboard radars are gyroscopically and/or computably stabilized. These features allow the presentation you see on the radar repeater to remain orientated (magnetic north at the top of the scope) even though the ship is in a turn. There is also a ship heading marker/cursor displayed on the radarscope that changes automatically as the ship changes course.

The radar repeaters used on board ship have the same features as those used ashore; that is, variable range control, off-center sweep and cursor, and range marks.

Precision Approach and Landing System

Introduction

PALS (formerly called the Automatic Carrier Landing System) includes the AN/SPN-46 and associated systems that enable pilots to perform precision instrument approaches to the aircraft carrier. To provide continuous capability to the pilot and controllers, the PALS has a precision tracking radar that is coupled to a computer data link.

PALS modes of operation

PALS has three general types of control. They differ on the basis of type of control (automatic or manual) and source of information (display or voice).

- Fully automatic approach (Mode I/IA)
- Manual controlled approach with PALS glide slope and lineup information provided by pilot cockpit display (Mode II/IIT)
- Conventional manual CCA in which the controller provides glide slope, azimuth, and range information by voice (Mode III)

AN/SPN-46

The AN/SPN-46 has two consoles each of which can track (lock on) two aircraft at a time. The SPN-46 also interfaces with the CATCC DAIR. With this interface, it is used to select the display of aircraft being tracked by the CATCC DAIR. This interface causes aircraft symbols and side numbers of DAIR-tracked aircraft to appear on the console display.

Automatic landing system

Besides providing precision tracking radar, the AN/SPN-46 has the capability of providing a completely automatic landing. When an aircraft approaches a carrier, the precision tracking radar monitors the aircraft's progress and feeds the position information to a computer. The computer measures the aircraft's position in relation to a preselected approach path. To maneuver the aircraft to the desired path, the computer determines what corrections are necessary. The corrections are then transmitted by radio to the aircraft. Equipment in the aircraft feeds the commands, through an autopilot, to the aircraft's control surfaces and throttle, and the aircraft reacts accordingly. The same corrections are also fed to the CCA operator's console, including information concerning the distance from the ship to the aircraft.

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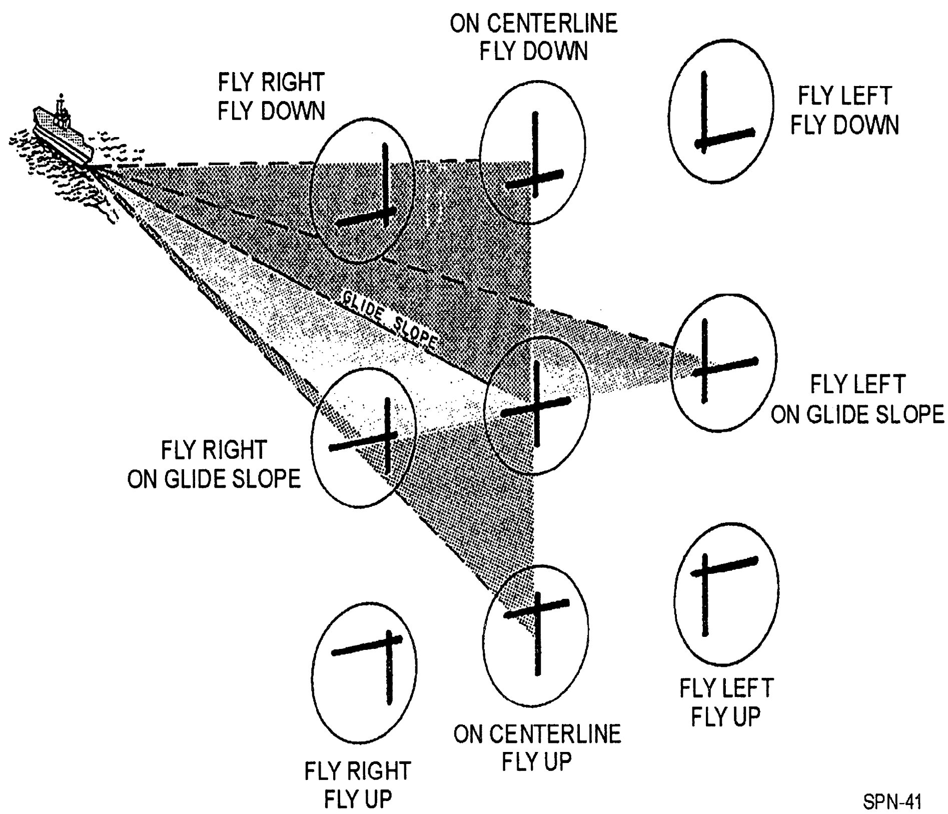
SPN-41 ICLS

The SPN-41 system is a completely independent guidance/navigation system that, besides providing a means for monitoring, affords the pilot another method of making an instrument approach to the ship. In this system, shipboard transmitters scan coded microwave signals aligned on the desired approach path. On the aircraft's instrument panel, the information from this system is displayed on an ILS-type cross-pointer needles display. A pilot can receive SPN-41 guidance information in excess of 20 miles from a ship. This type of approach requires the pilot to transfer to a visual landing aid such as the fresnel lens system prior to touchdown.



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SPN-41 usage

The pilot needs to monitor his or her progress during a manual or fully automatic approach. The SPN-41 allows the pilot to monitor and crosscheck the SPN-46 performance.

The SPN-41 has capabilities that allow it to serve the following functions:

Capabilities	SPN-41 serves as...
Extended range	A feeder system for the SPN-46
Independent guidance and navigation system	An independent landing monitor (ILM) to allow the pilot to monitor and crosscheck SPN-46 performance during a manual or fully automatic approach
	A backup when the SPN-46 equipment fails that allows the pilot to continue a precision approach

ARA-63

The ARA-63 receiver/decoder is used in the aircraft in conjunction with the SPN-41 system. It is used by the pilot to obtain carrier line-up prior to entering the SPN-46 acquisition gate. The ARA-63 is also used to monitor SPN-46 automatic precision approach performance in the aircraft.

Ancillary equipment

The ancillary equipment that is normally located in the CCA control room includes the following:

- Communications consoles—models of equipment vary but their function is equivalent to communications consoles used at shore stations
- Gyro repeater—indicates the ship's true course
- Deck condition lights—indicate ready or fouled deck
- SPN-44 radar—indicates the airspeed of aircraft on final approach, either true or closing, as selected by CCA or the LSO

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Ancillary equipment (continued)

- Integrated Launch and Recovery Television System (ILARTS) and CCTV displays—used to monitor and record aircraft landings
- Vertical edge-lighted status board—used to record and display aircraft missions, fuel states, profiles, etc.

Integrated Shipboard Information System

A new system scheduled for installation on board CVNs is the Integrated Shipboard Information System (ISIS). This system is designed to replace edge-lighted status boards and automate data entry and display of flight operations information.

Optical Landing Systems

Introduction

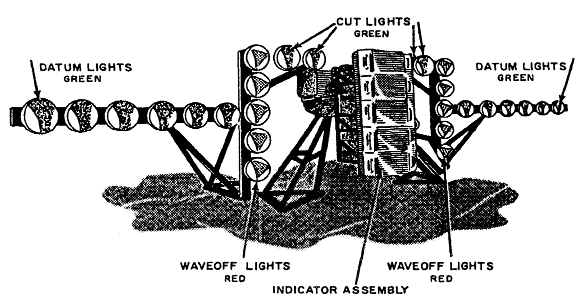
Besides CCA equipment, there are optical systems on board a carrier that aid pilots in landing aboard the carrier.

Fresnel lens optical landing system

The purpose of the FLOLS is to provide the pilot with a visual indication of his or her relative position with respect to a prescribed glide slope. This glide slope, as determined by the lens settings, is designed to bring the aircraft down to the deck within the cross-deck pendant area with a safe clearance above the stern ramp of the carrier.

A yellow bar of light is displayed over the full width of the lens box. The lens box may be considered a window through which the pilot views the bar of light. The bar of light appears as though it were located approximately 150 feet beyond the window. When viewed from anywhere on the prescribed glide slope, this bar of light (ball) appears in line with the green datum lights. The ball rises above the datum lights as the pilot rises above the glide slope, and eventually slides off the top of the lens box when the pilot is more than 3/4 degree above the glide slope. The same holds true as the pilot drops below the datum lights and the ball finally slides off the bottom of the lens box.

At great distances from the lens unit, it is difficult to distinguish the relative position of the ball with respect to the datum lights. The reason is the ball can be distinguished before the green datum lights become visible. Pilots are therefore provided with a warning of low ball by installing a RED lens in the bottom cell of the lens box. Thus, regardless of distance, when the ball is RED instead of YELLOW, a pilot will know when he or she is too low or too high.



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Manually operated, visual landing aid system

MOVLAS is an emergency system that is intended to be used when the primary optical landing system is rendered inoperative. The system presents glide slope information to the pilot of an approaching aircraft in the same visual form presented by the FLOLS. As a substitute for FLOLS, the MOVLAS has three modes of operation.

- Mode I has a light box installed directly in front of the FLOLS lens. It acts as a substitute for the normal ball presentation, but it still uses the datum, waveoff, and cut lights of FLOLS.
- Mode II is completely independent of the FLOLS. It is located between 75 and 100 feet aft of the inoperable system. Besides the ball presentation, it consists of reference datum, waveoff, and cut lights.
- Mode III installation is similar to Mode II but is located on the starboard (right) side of the flight deck aft of the island structure.

ILARTS

Introduction

The Integrated Launch and Recovery Television Surveillance System (ILARTS) (formerly PLAT) records aircraft launches and recoveries. Through remote cameras and monitors, ILARTS provides an instant picture of all launches and landings plus the capability of tape recordings for future replays.

ILARTS components

ILARTS in concert with the ship's closed-circuit television (CCTV) consists of four to six cameras, monitors, control synchronization, a video tape recorder, and associated power and distribution systems.

Centerline camera

The centerline camera pickup station is unmanned and consists of two units (primary and backup) that provide instantaneous (real-time) monitoring of aircraft landings. The point-in-space (window) viewed by the centerline cameras is stabilized to compensate for the pitch and roll of the ship. The FLOLS is gyroscopically stabilized to maintain a constant reference to earth's horizon regardless of the pitch and roll due to sea state, ship maneuvers, and so forth. Both centerline cameras are stabilized from the same source as the FLOLS. Within the limits of its corrective ability, this stabilization compensates for the camera motion so that the camera's field remains on target regardless of the ship’s pitch and roll. From their centerline position, these cameras follow the aircraft from approach to touchdown.

Island camera

The island camera is mounted on the superstructure and is manned by an operator. The operator uses this camera to monitor aircraft side numbers in addition to recording launches, general flight deck activities, and accidents. During landings, the island camera takes over coverage at touchdown and provides final coverage of the landing.

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Monitors

Monitoring units are located in various compartments such as the pilots' ready rooms, CCA, captain's bridge, and the LSO's platform. In this manner, distribution of the "topside activity" provides a convenient observation media for the general situation on the flight deck. Another feature is the availability of the transmitted data to widely dispersed locations and personnel. This feature contributes to a coordinated team effort throughout the ship. All data are simultaneously recorded; the tapes may then be stored for later use as debriefing material and as training aids.

CHAPTER 6

AIRSPACE CLASSIFICATION

Overview

Introduction

The FAA is responsible for the safe and efficient use of airspace in the United States. Since this airspace includes areas where military aircraft operations take place, Navy air traffic controllers must comply with FAA air traffic rules and regulations.

There are two categories of airspace or airspace areas: regulatory and nonregulatory. Regulatory airspace is designated, altered, or revoked by rule, regulation, or order. Within these two categories, there are four types: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of operations conducted within the airspace, the level of safety required, and the national and public interest.

This chapter introduces you to those operational requirements and terms associated with these areas of airspace and is compiled from information contained in the *FARs, AIM,* and *Procedures for Handling Airspace Matters,* FAA Order 7400.2.

Objective

The material in this chapter will enable you to:

- Recognize the types of airspace.
- Identify the purpose of airways.
- Identify the purpose of jet routes.
- State how airspace is charted.
- Identify rules and restrictions associated with each type of airspace.

Continued on next page

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chanter:

Acronym	Meaning
AGL	Above ground level
AIM	Aeronautical Information Manual
ATC	Air traffic control
DoD	Department of Defense
FAA	Federal Aviation Administration
FACSFAC	Fleet area control and surveillance facility
FAR	Federal aviation regulation
ft	feet
FL	Flight level
IFR	Instrument flight rules
L/MF	Low/medium frequency
mi	mile
MOA	Military operations area
MSL	Mean sea level
MTR	Military training route
NA	Not applicable
nm	Nautical mile
VFR	Visual flight rules
VOR	VHF omni-directional range
VORTAC	VHF omni-directional range/tactical air navigation

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Topics

This chapter is divided into four sections:

Section A
Controlled Airspace

Overview

Introduction

As an air traffic controller, you will need to become familiar with controlled airspace, its restrictions and limitations, and the dimensions associated with the different classifications of airspace.

In this section

This section covers the following topics:

VOR and L/MF Airways System and Jet Route System

Introduction

Two route systems have been established for air navigational purposes within the National Airspace System (NAS)—the VOR and L/MF airways system and the jet-route system. These systems can be viewed as highways in the sky. They are designated routes and are depicted on aeronautical charts. Refer to the *FARs, AIM,* and FAA Order 7400.2 for more detailed information.

VOR and L/MF airways

The VOR and L/MF airways system consists of airways designated from 1,200 feet above the surface up to but not including 18,000 MSL. To the extent possible, VOR and L/MF airways align in an overlying manner to ease the transition between each.

VOR airways are depicted in blue on aeronautical charts and are identified by a *V* (spoken: Victor) followed by an airway number (e.g., V11). L/MF airways are identified by color name and number (e.g., Green One). Green and red L/MF airways are plotted east and west. Blue and amber L/MF airways are plotted north and south.

Except in Alaska, VOR airways are established solely on VOR or VORTAC navigation facilities.

Jet routes

The jet route system consists of routes established from 18,000 feet MSL (FL180) to 45,000 feet MSL (FL450) inclusive.

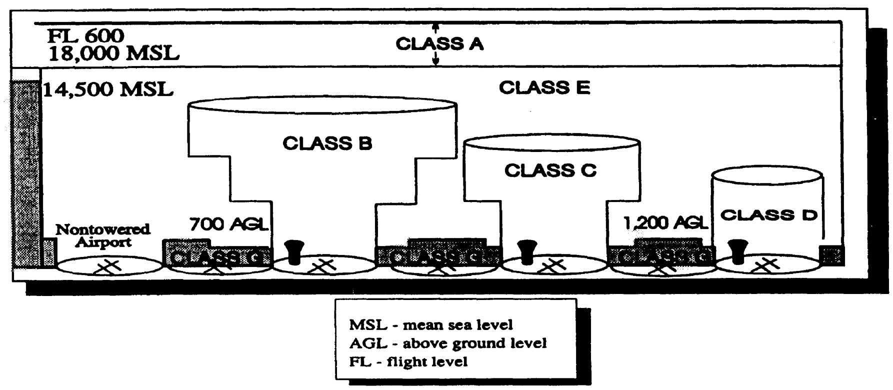
They are depicted on aeronautical charts and identified by a *J* (spoken: Jay) for jet route followed by the airway number (e.g., J14).

Except in Alaska, jet routes are established solely on VOR or VORTAC navigation facilities.

Controlled Airspace

Introduction

Controlled airspace is an airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Controlled airspace is divided into five classifications, Class A, B, C, D, and E. Each class of airspace has associated flight services. A sixth class of airspace, Class G, encompasses uncontrolled airspace. The following figure shows a composite diagram of all the classifications and the following sections give a brief definition of each class of controlled airspace. Refer to the FAA Order 7400.2, *AIM,* and the *FARs* for more detailed information.



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Airspace limits, rules, and restrictions

The table below outlines some of the limits, rules, and restrictions associated with each class of controlled airspace.

Airspace Class	Configuration	Height Limits	VFR Weather Minimums	
			Flight Visibility	**Distance from Clouds**
A	NA	18,000 ft MSL up to and including FL600— positive control of aircraft and IFR apply	NA	NA
B	Individually tailored consisting of a surface area and two or more additional areas	Surface to 10,000 ft MSL surrounding the busiest U.S. airports	3 statute mi	Clear of clouds
C	Individually tailored usually consisting of a 5 nm radius core surface area, an outer circle with a 10 nm radius, and an outer area which is normally 20 nm	Surface to 4,000 ft above the airport elevation— core area is surface to 4,000; outer circle area is 1,200 ft to 4,000 ft; outer area to the ceiling of the approach control's delegated airspace	3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal

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Controlled Airspace, Continued

Airspace limits, rules, and restrictions

Table continued from page 6-A-4.

Airspace Class	Configuration	Height Limits	VFR Weather Minimums	
			Flight Visibility	**Distance from Clouds**
D	Individually tailored and includes published instrument procedures	Surface to 2,500 ft above the airport elevation	3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal
E	Airspace not designated as Class A, B, C, D, or G	Except for a upper vertical limit of 18,000 ft, no defined vertical limit—extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace	**Less than 10,000 ft MSL**—3 statute mi **At or above 10,000 ft MSL**—5 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal 1,000 ft below 1,000 ft above 1 statute mi horizontal

Where controlled airspace is charted

Class A airspace is not specifically charted. Class B, C, D, and E airspace is charted on:

- Sectional charts
- IFR enroute low-altitude charts
- Terminal area charts

Section B
Uncontrolled Airspace

Overview

Introduction

Class G airspace encompasses all airspace not considered A, B, C, D, and E and is classified as uncontrolled.

In this section

This section covers the following topic:

Uncontrolled Airspace

Introduction

Airspace that is not controlled is classified as Class G airspace.

Regulations concerning Class G airspace

The table below defines the limits, rules, and restrictions associated with uncontrolled airspace.

Airspace Class	Configuration	Height Limits	VFR Weather Minimums	
			Flight Visibility	**Distance from Clouds**
G	Airspace not designated as Class A, B, C, D, or E	Uncontrolled	**1,200 ft or less above the surface (regardless of MSL altitude)—**	
			Day—1 statute mi	Clear of clouds
			Night—3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal
			More than 1,200 ft above the surface but less than 10,000 ft MSL—	
			Day—1 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal
			Night—3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal

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Regulations concerning Class G airspace

Table continued from page 6-B-2 1

Airspace Class	Configuration	Height Limits	VFR Weather Minimums	
			Flight Visibility	Distance from Clouds
G			**More than 1,200 ft above the surface and at or above 10,000 ft MSL—**5 statute mi	1,000 ft below 1,000 ft above 1 statute mi horizontal

Section C
Special Use Airspace

Overview

Introduction

Special use airspace is airspace in which the:

- activities in the area must be confined because of their very nature, or
- limitations must be imposed upon aircraft operations that are not part of the activities taking place in this area.

The vertical and horizontal limits of special use airspace areas and their periods of operation are defined.

Except for controlled firing areas, the areas and their periods of operation are depicted on aeronautical charts.

In this section

This section covers the following topics:

Prohibited and Restricted Areas

Introduction

As an air traffic controller, you must be familiar with any prohibited or restricted airspace that is in your area of responsibility.

Prohibited areas

Prohibited areas are established in FAR, Part 73, and thus are considered regulatory airspace. Prohibited areas are published in *Special Use Airspace,* FAA Order 7400.8, and *FLIP* AP/1A and are depicted on aeronautical charts.

Prohibited areas contain airspace of defined dimensions within which the flight of aircraft is prohibited. Such areas are established for security reasons or other reasons associated with the national welfare, for example, airspace over the White House.

Prohibited areas are identified by the prefix letter "P" followed by a dash, a two-digit number, and a location (city or town or military reservation), for example, "P-56 District of Columbia."

Restricted areas

Restricted areas are established in *FAR,* Part 73, and thus are considered regulatory airspace. Restricted areas are published in FAA Order 7400.8 and *FLIP* AP/1A and are depicted on aeronautical charts.

Restricted areas contain airspace identified by an area on the surface within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Such areas are established for artillery firing, aerial gunnery, or guided missiles.

Restricted areas are depicted on the enroute charts for use at the altitude or flight level being flown. For joint-use restricted areas, the name of the controlling agency is shown on the charts. Unless otherwise requested by the using agency, the phrase "NO A/G" is shown on the charts for all prohibited areas and nonjoint-use restricted areas. This phrase indicates that voice communications are not maintained with aircraft operating in these areas.

Restricted areas are identified by the prefix letter "R" followed by a dash, a four-digit number, and a location (city or town or military reservation and state), for example, "R-4813 Carson Sink, NV." A letter suffix is assigned to denote subdivisions, for example, "R-4803N Fallon, NV."

Warning and Alert Areas

Introduction

Warning and Alert Areas provide airspace for pilots to practice various tactical maneuvers. To provide necessary ATC services, you must know the location of any warning or alert areas in your area of control jurisdiction and the type of aircraft operations conducted in these areas.

Warning areas

A warning area is airspace that contains hazards to nonparticipating aircraft. Warning areas are developed with defined dimensions extending from 3 miles outward from a coastline. Warning areas may be located over domestic or international waters.

Fleet operating areas off the East, West, and Gulf coasts of the United States consist primarily of warning areas under the jurisdiction of a U.S. Navy FACSFAC.

Warning areas are identified by the prefix letter "W" followed by a dash, a two- or three-digit number, and a location (city or town or area or military reservation and state), for example, "W-72 Vacapes, VA." A letter suffix is assigned to denote subdivisions, for example, "W-72A Vacapes, VA." Warning areas are nonregulatory airspace. Warning areas are published in FAA Order 7400.8 and *FLIP* AP/1A and are depicted on aeronautical charts.

Alert areas

Alert areas are designated to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. These are areas in which pilots should be particularly alert. All activity within an alert area must be conducted according to *FARs* without waiver. Pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

U.S. Navy alert areas exist around many outlying fields (OLFs) where pilot training and field carrier landing practices take place.

Alert areas are identified by the prefix letter "A" followed by two or more digits, for example, "A-680 Coupeville, WA." Alert areas are nonregulatory airspace. They are published in FAA Order 7400.8 and *FLIP* AP/1A and are depicted on aeronautical charts.

Military Operations Areas

Introduction

MOAs consist of airspace defined by altitude and geographical location.

Military operations area

MOAs are established to separate certain military training activities from IFR air traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by the ATC authority. Otherwise, the control facility must reroute or restrict the nonparticipating aircraft.

Nonhazardous activities such as combat tactics, aerobatics, intercepts, instrument training, aerial refueling, and formation flight training take place in MOAs.

MOAs shall be identified by the use of a nickname from a geographical location or any other common name, for example, "Hunter" or "Gator", and if desired, further identified in numerical sequence, for example, "Gabbs 1") Gabbs 2", and so forth. Cardinal points, letters, or "high" and "low" may be used to identify subsections, for example, "Mayport High." MOAs are nonregulatory airspace. They are published in FAA Order 7400.8 and are depicted on sectional, terminal area, and IFR enroute low-altitude charts.

Controlled Firing Areas

Introduction

Controlled firing areas contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft.

Controlled firing areas

Controlled firing areas shall only be considered for those activities which are either of short duration or of such a nature that they could be immediately suspended on notice that such activity might endanger nonparticipating aircraft. Examples of such activities include field artillery, blasting, ordnance disposal, and chemical disposal.

The distinguishing feature of the controlled firing area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. Controlled firing areas are nonregulatory airspace and are not charted because they do not cause a nonparticipating aircraft to change its flight path.

Section D
Other Airspace

Overview

Introduction

Airspace that is not controlled, uncontrolled, or special use is categorized as other airspace.

In this section

This section covers the following topics:

Military Training Routes

Introduction

To be proficient, the military services must train in a wide range of airborne tactics including "low level" combat tactics. The required maneuvers and high speeds are such that they may make the see-and-avoid aspect of VFR flight more difficult without increased vigilance. The MTR program is a joint DoD and FAA venture to ensure the greatest practical level of safety for these flight operations. Additional information concerning MTRs can be found in *Special Military Operations,* FAA Order 7610.4 and *FLIP* AP/1B.

Military training route definition

Generally, MTRs are established below 10,000 feet MSL and for speeds in excess of 250 knots. Routes are developed as follows:

- Routes above 1,500 feet AGL are developed to be flown to the maximum extent possible under IFR conditions.
- Routes at 1,500 feet AGL and below are generally developed to be flown under VFR conditions.
- Routes may be established for descent, climbout, and designated mountainous terrain.

Published information

MTRs are published in sectional charts, IFR low-altitude enroute charts, and FLIP Area Planning (AP/1B).

Route designation

Route designations are made as follows:

Military Training Route Designation	
IFR Military Training Routes-IR	Operations on these routes are conducted by following IFR regardless of weather conditions.
VFR Military Training Routes-VR	Operations on these routes are conducted by following VFR. The flight visibility must be 5 miles or more, and the ceiling must be 3,000 feet AGL or greater.

Continued on next page

Route identification

Routes are identified as follows:

Route	Route Identification
IR and VR at or below 1,500 feet AGL (with no segment above 1,500 AGL)	A four-digit number such as IR1006 or VR1007
IR and VR above 1,500 feet AGL (segments of these routes may be below 1,500 AGL)	A three-digit number such as IR008 or VR009
Alternate IR and VR routes or route segments	The basic or principle route designation followed by a letter suffix such as IR008A or VR1007B

Airport Advisory Areas

Introduction

As a Navy air traffic controller providing approach control service, you may have a satellite airport within your area of jurisdiction which lies within an airport advisory area.

Airport advisory area

An airport advisory area is the area within 10 statute miles of an airport where a control tower is not operating but where a Flight Service Station (FSS) is located. At such locations, the FSS provides advisory service to arriving and departing aircraft.

A local airport advisory program on the common traffic advisory frequency (CTAF) is established at those airports which lie within an airport advisory area. It is not mandatory that pilots participate, but it is strongly recommended they do.

Parachute Jump Areas

Introduction

Parachute jump operations have the potential to disrupt the normal flow of air traffic. Knowledge of jump areas will help ensure that you provide safe air traffic service.

Parachute jump area

Parachute jump areas are established to identify airspace in which parachute jump operations are routinely conducted. These areas are identified by the use of a nickname from a geographical location or any other common name, for example, "Coupeville OLF" or "Lewellen Drop Zone." Parachute jump areas are described in terms of location (radial and DME fix or quadrant), vertical (altitude) extent, and specified period of time such as daily sunrise to sunset.

Parachute jump areas are published in *FLIP* AP/1A and *Airport/Facility Directory* booklets.

CHAPTER 7

FLIGHT ASSISTANCE SERVICES

Overview

Introduction

As an Air Traffic Controller assigned to the flight planning branch of an air traffic control facility, the assistance you provide to pilots is very important. Your assistance plays a critical role in the safety of the flight as well as providing a smooth transition through the air traffic control system. You will need a thorough understanding of the information presented in this chapter to perform as an Air Traffic Controller.

Objectives

The material in this chapter will enable you to:

- Describe the functions of the flight planning branch.
- Identify the assistance given to a pilot by the Air Traffic Controller (AC) in planning a flight.
- Identify the conditions that require search and rescue (SAR) operations, and state the procedures to be followed in effecting SAR for both instrument flight rules (IFR) and visual flight rules (VFR) flights.
- Identify individual and activity responsibilities for originating and executing procedures under the notice to airmen (NOTAM) system.

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chanter.

Acronym	Meaning
AC	Air Traffic Controller
AFSS	Automated flight service station
AIM	Aeronautical Information Manual
AIRAD	Airmen Advisory
ALNOT	Alert notice
ARTCC	Air route traffic control center
ATC	Air traffic control

Continued on next page

Acronyms (continued)

Table continued from page 7-1.

Acronym	Meaning
ATCFO	Air Traffic Control Facility Officer
ATIS	Automatic terminal information service
AWN	Automated weather network
BASOPS	Base Operations
CHUM	Chart updating manual
CNO	Chief of Naval Operations
DoD	Department of Defense
DTG	Date-Time Group
DVFR	Defense Visual Flight Rules
ETA	Estimated time of arrival
ETE	Estimated time enroute
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FLIP	DoD Flight Information Publication
FSS	Flight Service Station
ICAO	International Civil Aviation Organization
ID	Identification
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
INREQ	Information Request
LABS	Leased A/B system
NAVAID	Navigational Aid
NOTAM	Notice to Airmen

Continued on next page

Acronyms (continued)

Table continued from page 7-2.

Acronym	Meaning
PIREP	Pilot weather report
QALQ	Code asking if aircraft has landed or returned to station
RCC	Rescue Coordination Center
SAR	Search and Rescue
SID	Standard instrument departure
SVFR	Special visual flight rules
STAR	Standard terminal arrival
TACAN	UHF Omnidirectional Navigational Aid
VFR	Visual Flight Rules
VIP	Very Important Person

Topics

This chapter is divided into four sections:

Section A
Flight Planning Branch Functions

Overview

Introduction

The function of the flight planning branch is to provide for planning, receiving, and processing flight plans as well as receiving and processing inbound flight information. The branch maintains a current inventory of aeronautical charts, publications, applicable directives, and NOTAM files. It also provides facilities for the aircrew to conduct flight planning.

In this section

This section covers the following topics:

Flight Planning Branch Personnel

Introduction

Personnel assigned to the flight planning branch are responsible for matters pertaining to flight planning, flight plan processing, and flight guard.

Billets and responsibilities

Billets and responsibilities of the flight planning branch personnel are contained in the following table:

Billet Description	Responsible To:	Duties and Responsibilities
Flight Planning Chief	ATCFO	• Procuring and maintaining required publications, directives, charts, and supplies • Maintaining flight planning facilities • Maintaining operational continuity between watches • Qualifying personnel • Apprising ATCFO of equipment readiness • Providing flight planning technical assistance to the ATCFO
Flight Planning Supervisor	Flight Planning Chief and Facility Watch Supervisor	• Dissemination of NOTAMs • Ensuring adequate supplies are available to the aircrew • Assisting the aircrew in flight planning and flight plan filing • Supervising the processing and transmitting of flight plan: and movement messages
Flight Planning Dispatcher	Flight Planning Supervisor	• Receiving, processing, posting, and transmitting flight plans and movement messages • Coordinating with other facilities regarding flight plans and movement messages • Handling communications, aircraft flight guard, and initiating overdue actions • Maintaining the NOTAM display

Duty Priority

Introduction

Because there are many variables involved, it is impossible to provide a list of duty priorities that apply to every situation. Each set of circumstances must be evaluated on its own merit, and when more than one action is required, you must exercise your best judgement based on known facts and circumstances. Action which appears most critical from a safety standpoint should be performed first.

Order of priorities

The following order of duty priorities is offered as a guideline:

Priority	Situation	Description
1	Emergency	Life or property is in imminent danger.
2	Inflight Services	Affecting aircraft in flight or otherwise operating on the airport service. Includes delivery of ATC clearances, advisories, or requests; issuance of military flight advisory messages, NOTAMs, SAR communications searches, flight plan handling, weather observations, PIREPs, and pilot briefings.
3	Preflight Services	Directly affect aircraft operations but provided prior to actual departure and usually by telephone. Includes pilot briefings, recorded data, flight plan filing and processing, and aircraft operational reservations.

Flight Planning Branch - Airfield Status Boards

Introduction

Airfield status boards for flight operations personnel and flight data boards for the general public display airfield information.

Airfield status boards

Airfield status boards provide general field information useful to pilots and flight planning personnel when they are planning a flight. The size, shape, and construction are site unique. Items normally included in an airfield status board are as follows:

- Current weather status (IFR or VFR)
- Runway in use
- Radio frequency usage
- Field NAVAID status
- Field radar status
- Field arresting gear status
- Pertinent remarks (anything that might affect the flight)

Preflight Planning

Policy

NATOPS General Flight and Operating Instructions, OPNAVINST 3710.7, states: "Before commencing a flight, the pilot in command shall be familiar with all available information appropriate to the intended operation. Such information should include but is not limited to available weather reports and forecasts, NOTAMs, fuel requirements, alternatives available if the flight cannot be completed as planned, and any anticipated delays."

Flight planning branch role

Much of a pilot's preflight planning is conducted in the flight planning branch of the facility. Although the overall responsibility for preflight planning rests with the pilot in command, you, as an AC, share the responsibility. You must ensure that charts and publications are up-to-date and available for the pilots use, and you must also be aware of any recent changes that might affect the safety of the flight.

The flight planning branch should have sufficient FLIPs, navigation equipment, and related information applicable to the mission of the facility. The following table lists the information that should be provided by the flight planning branch:

Publication/Information	Requirements
FLIPs (Sufficient quantity for mission)	Planning, area charts, enroute low altitude, enroute high altitude, enroute supplements, terminal low altitude, terminal high altitude, SIDs, STARs
NOTAM	Shall be maintained up to date for ready reference and displayed according to *DoD Notice to Airmen (NOTAM) System,* OPNAVINST 3721.20
Publications that shall be made available in limited quantities for reference (where required)	*FAR,* Part 91; AIM; Contractions Manual; Location Identifiers; NOTAM Publication; Foreign Clearance Guide; International Flight Information Manual; International NOTAMs; Air Almanac; Catalog of Maps, Charts, and Related Products (Part 1); Bulletin or Bulletin Digest; CHUM/CHUM Supplement.
Information that shall be prominently displayed (appropriate to the mission of the air activity)	A general flight planning chart, local area flight planning charts of suitable scale showing VFR arrival and departure corridors, a scaled terrain/obstruction map to include overlays depicting current SID courses and their proximity to known hazards

Section B
Flight Planning

Overview

Introduction

Pilots in command of naval aircraft or formation flight leaders must prepare and submit flight plans. ACs in the flight planning branch play a vital role in assisting the pilots in preparing and filing flight plans.

In this section

This section covers the following topics:

Flight Plan Forms

Policy

NATOPS General Flight and Operating Instructions, OPNAVINST 3710.7, states: "A flight plan appropriate for the intended operation shall be submitted to the local air traffic control facility for all flights of naval aircraft except the following:

a. Flights of operational necessity.

b. Student training flights under the cognizance of the Chief of Naval Air Training (CNATRA) conducted within authorized training areas. CNATRA shall institute measures to provide adequate flight following service."

Weather considerations

Flight plans are filed based on:

- Actual weather at the point of departure
- The existing and forecast weather for the route of flight
- The destination and alternate airfield forecasts for the period of 1 hour before ETA until 1 hour after ETA

NOTE: A DD Form 175-1 (Flight Weather Briefing) must be completed for all flights except those conducted under VFR conditions where a VFR certification stamp is an acceptable alternative. This form gives pilots a detailed overview of forecasted weather conditions along a planned route of flight.

Authorized signature

Except when a daily flight schedule is used in lieu of a flight plan form, the pilot in command or formation leader shall sign the flight plan for his or her flight.

Retention of flight plans

Copies of flight plans, squadron flight schedules, operations logs, aircraft clearance and arrival reports, and weather forms must be retained on file for 3 months. If a flight plan is filed at a civilian airport, the FAA will hold the flight plan for 15 days and then forward it to the home station of the aircraft.

Continued on next page

Flight plan forms for military pilots

The following table lists the authorized forms used to submit flight plans by military pilots:

Form Name	When Form is Used	Remarks
DD Form 175, Military Flight Plan	Used for other than local flights originating from airfields in the United States at which a military operations department is located.	Completed according to FLIP, *General Planning*. May be used for stopover flights. Pilot in command must ensure that the flight plan is closed out if the flight terminates at any intermediate stop.
Abbreviated DD Form 175 or Daily Flight Schedule	Used when the flight will be conducted within the established local flying area and adjacent offshore operating or training areas.	May be used only if the following requirements are met: ● Sufficient information relative to the flight is included. ● Facility ops maintains cognizance of each flight plan and assumes responsibility for initiating any overdue action or issuing in-flight advisory messages. ● The flight shall not be conducted in IMC within controlled airspace except as jointly agreed to by the local naval command and the responsible air traffic control agency.
FAA Form 7233-1 or 3, FAA Flight Plan	Used in lieu of DD Form 175 at airfields in the U. S. at which a military operations department is not located.	None
DD Form 1801, DoD International Flight Plan	Used for flights conducted in international airspace according to ICAO rules and procedures	Not intended for use in conjunction with DD Form 175.

VIP Flight Plan Codes

Introduction

The aircraft commander enters VIP codes in the Remarks section of the flight plan. An AC who works in the flight planning branch must be completely familiar with these codes and be able to follow facility notification procedures to preclude embarrassment to the VIP or his or her command and commanding officer.

Responsibilities

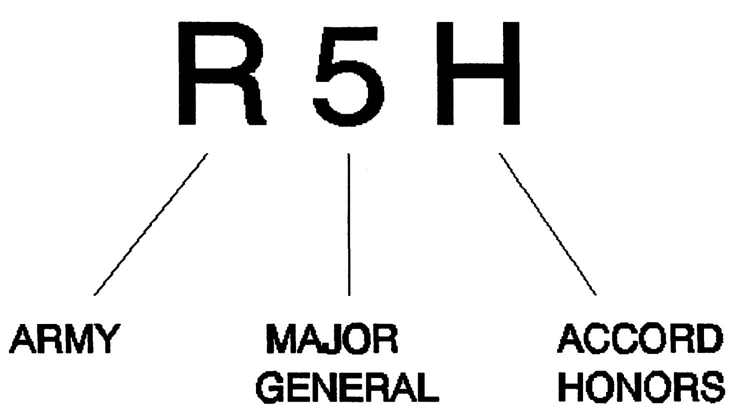
The aircraft commander who is transporting VIPs ensures that the flight plan reflects that VIPs are on board and what their requirements are. The aircraft commander also gives an advance voice report approximately 15 to 30 minutes before arrival. The AC notifies designated personnel at his or her command of the aircraft commander's advance report.

Format

VIP codes are entered in the Remarks section of DD Form 175, and consist of three parts:

- Service designator letter indicating the branch of service
- A number code for the highest rank or grade on board
- A letter code indicating what honors, if any, the VIP desires

The following is an example of a VIP code and the meaning associated with each part of the code.



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Service designator

The following table lists the service designator letters used in VIP codes and their associated meanings:

Letter	Service Category
A	Air Force
R	Army
C	Coast Guard
M	Marine Corps
V	Navy
S	Civilian
F	Foreign Civilian or Military

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VIP code number

The following table lists VIP code numbers and personnel associated with each number. This table lists all the code numbers; however, it does not list all personnel associated with each. For a complete list, see FLIP, *General Planning,* chapter 4.

Number	Examples of Personnel Associated with VIP Code Numbers
1	President of the United States, Heads of State of Foreign Countries, and Reigning Royalty
2	Vice President of the United States, Former Presidents, Cabinet Members, State Governors, Secretary of the Navy, CNO
3	Special Assistants to the President, Generals and Admirals (4-Star), Under Secretary of the Navy
4	Lieutenant Generals and Vice Admirals (3-Star), Director of the FBI, Mayors
5	Major Generals, Rear Admirals Upper Half (2-Star)
6	Brigadier Generals and Rear Admirals Lower Half (1-Star)
7	Captains (USN) and Colonels (USAF, US ARMY, USMC), Comparable rank officers of friendly nations
8	Senior enlisted advisors of the armed services (Master Chief Petty Officer of the Navy)

Honor code letters

The following table lists the honor code letters and their associated meanings:

Honor Code Letter	Meaning
H	Accord honors under Navy regulations as appropriate
N	Accord no honors, request informal visit with commander
O	Request nothing

Service Codes

Introduction

The pilot enters service codes in the Remarks section of the flight plan. These codes alert the destination station of services the aircraft will require upon arrival.

Codes

The following table lists the service codes and their respective meanings that a pilot may use on a flight plan:

Code	Meaning
PPR	PPR (Prior Permission Required) number, if applicable
S	Service required
R	Aircraft will remain overnight

Phraseology

When an AC verbally passes a flight plan containing the above codes, he or she should use the phraseology shown in the following table:

Code	Phraseology
S	Servicing required
R	Remain overnight (R2 = remain over 2 nights)

Recording Flight Data, Control Symbology, and Flight Progress Strips

Introduction

Flight progress strips are used to post current data on air traffic and the clearances required for air traffic control and air traffic services. As the AC, you will be working extensively with flight progress strips and the information posted on them. Misinterpretation of the data on a flight progress strip could be catastrophic; therefore, it is extremely important that a controller be completely familiar with the required reading in this section.

Recording flight data

When recording flight data, use only plain language, abbreviations, or contractions contained in the *Contractions,* FAA Order 7340.1. Additionally, use only the station and NAVAID location identifiers contained in *Location Identifiers,* FAA Order 7350.6. This will help to ensure there is no misunderstanding when the data is read by another controller.

International identifiers are contained in *Location Indicators,* ICAO Document 7910.

Additional information

For a complete discussion on recording flight data, control symbology, and flight progress strip procedures, refer to *Air Traffic Control,* FAA Order 7110.65 and *Flight Services,* FAA Order 7110.10.

Section C
Flight Handling

Overview

Introduction

As an AC who works in the flight planning branch, VFR or IFR flight handling is part of your responsibilities. Your actions will ensure that the proper notifications are made throughout the ATC system, and that the aircraft will receive VFR or IFR SAR assistance when needed.

In this section

This section covers the following topics:

VFR Flight Handling

Introduction

VFR flight handling ensures that the proper notifications are made throughout the ATC system during a VFR flight. This service is critical when a VFR aircraft requires VFR SAR assistance.

Flight notification message

Activate a VFR flight plan when you receive a departure report. A departure report or specific arrangements to activate the flight plan must be received within 1 hour of the proposed departure time. If neither is received, you should consider the flight plan canceled and file it.

The departure station shall transmit a flight notification message to the tie-in FSS (a telephone or interphone may be used for flights of 30 minutes or less). The flight notification message shall contain the following items:

- Type of flight plan
- Aircraft identification
- Aircraft type
- Departure airport
- Destination
- ETA (if more than 24 hours, may use DTG)
- Remarks

If the pilot elects to close the flight plan with a station other than the designated tie-in facility, send the flight notification message to both stations with remarks.

NOTE: Designation tie-in AFSS/FSS are listed in *Location Identifiers,* FAA Order 7350.6.

Enroute changes

When the pilot of an aircraft on a VFR flight plan notifies you of a major flight plan change, take the following actions:

Change	Information to Obtain from Pilot	Controller Action
Destination Change	Flight plan type, aircraft ID, aircraft type, departure airport, old destination, present position, altitude and route, new destination, ETE	Transmit a flight notification message to departure station as well as to the original and new destination stations

Continued on next page

Enroute changes (continued)

Table continued from page 7-C-2.

Change	Information to Obtain from Pilot	Controller Action
Change from IFR to VFR	A complete new flight plan	Transmit flight notification message to destination tie-in station
Change ETE	New ETA	Forward new information to destination station

IFR Flight Handling

Introduction

All procedures and reports required for handling VFR flights also apply to IFR flights. Additional flight plan handling is required to provide separation between aircraft operating IFR and, many times, certain reports must be sent to both flight service and the ARTCC.

Transmitting IFR flight plans

Federal aviation regulations require, in part, that a pilot file a flight plan and obtain an ATC clearance before operation within controlled airspace according to IFR rules. When a pilot files an IFR flight plan, it must be transmitted to the ARTCC within whose control area IFR flight is proposed to begin. The IFR flight plan proposal is sent to the ARTCC via LABS communications systems when the aircraft's proposed departure time is 15 minutes or more from transmittal time. When time is critical, the message is transmitted via interphone.

NOTE: When a flight is to depart after 0500 local time on the day following the filing of the flight plan, do not transmit the flight plan to the ARTCC until after 0000 local time. Flight plan storage is zeroed out at midnight.

Composite IFR/VFR flight plans

When a pilot files a composite flight plan that contains both an IFR and VFR portion, the flight plan is transmitted to the ARTCC in the area of responsibility for which the IFR portion of the flight originates.

IFR departure reports

Unless alternate procedures are prescribed in a letter of agreement or automatic departure messages are being transmitted between automated facilities, you should forward IFR aircraft departure times to the facility from which the ATC clearance was received.

Normally, Navy ATC facilities use automated departure messages (DM) to activate the IFR handling process. Also, Flight Planning personnel transmit an IFR flight notification message via LABS to the destination airport.

IFR arrival reports

When the destination Flight Planning personnel receive an IFR flight notification message, they hold it in suspense until receiving an arrival time from the control tower. Just as IFR handling is initiated by automation, it is also terminated by automation. Flight Planning personnel will send an arrival report via LABS to the departure airport **only** when requested by the departure airport.

Continued on next page

Flight advisory messages

Flight advisory messages are messages that are relayed to both IFR and VFR aircraft in flight. Flight advisory messages are only issued when the aircraft will encounter hazardous conditions or when hazardous conditions may arise.

When the aircraft destination is a civil airport, the destination FSS issues advisories to inbound aircraft. If the destination is a military base, base operations issues these advisories.

VFR SAR Procedures

Introduction

SAR is a service which seeks missing aircraft and assists those found to be in need of assistance. This lifesaving service is provided through the cooperative efforts of the federal agencies signatory to the National SAR Plan and the agencies responsible for SAR within each state.

By federal interagency agreement, the National SAR Plan provides for the effective use of all available facilities in all types of SAR missions. These facilities include aircraft, vessels, pararescue, and ground rescue teams. The services provided include search for missing aircraft, survival aid, rescue, and emergency medical help for the occupants after an accident site is located.

The U.S. Coast Guard is responsible for coordination of SAR for the Maritime Region, and the U.S. Air Force is responsible for SAR for the Inland Region.

As an AC who works in the flight planning branch, you have important responsibilities regarding SAR procedures. Information pertinent to SAR should be passed through any ATC facility or be transmitted directly to the RCC by telephone.

Responsibility for SAR action

Flight service stations serve as central points for collecting and disseminating information on overdue or missing aircraft that are not on an IFR flight plan. The departure station is responsible for SAR action until it receives the destination station's acknowledgment of the flight notification message. Once this acknowledgment is received, the destination station assumes responsibility for SAR action.

SAR action is initiated for VFR aircraft based on the following time frames:

Situation	Consider Aircraft Overdue
Aircraft is on a VFR or DVFR Flight Plan	30 minutes after its ETA and communications or location cannot be established.
Aircraft is not on a Flight Plan	At the actual time a reliable source reports the aircraft to be at least 1 hour late at its destination.

Continued on next page

Responsibility for SAR action (continued)

Table continued from page 7-C-5.

Situation	Consider Aircraft Overdue
Aircraft is receiving a "Hazardous Area Reporting Service"	If contact is lost for more than 15 minutes, alert SAR.

NOTE: Hazardous Area (Lake, Island, Mountain, or Swamp) Reporting Service programs are contained in the *AIM*.

Overdue aircraft action (continued)

As soon as a VFR or DVFR aircraft (military or civilian) becomes overdue, the destination station (including intermediate destination tie-in station for military aircraft) shall attempt to locate the aircraft by checking all adjacent airports. Also, the destination station shall check appropriate terminal area facilities and ARTCC sectors.

If this communication check does not locate the aircraft, the messages in the following table are issued:

Time	Message	Remarks
Immediately after communications check	QALQ	Transmit to departure tie-in FSS or FSS where flight plan is on file.
30 minutes after overdue (or reply to QALQ is negative—if sooner)	INREQ	Transmit to departure station, RCC, FSSs, ARTCCs, and flight watch control stations (with comm. outlets) along the aircraft route of flight.
1 hour after the INREQ was issued (or replies to INREQ are negative—if sooner)	ALNOT	Transmit to the Regional Operations Center, RCC, and other facilities within the search area.

Continued on next page

QALQ

The destination station transmits a QALQ message to the departure station after the initial communication check fails to locate the aircraft. Upon receipt of the QALQ inquiry, the departure station shall check locally for any information about the aircraft and take the following action:

- If the aircraft is located, notify the destination station.
- If unable to locate the aircraft, send all additional information to the destination station, including any verbal or written remarks made by the pilot that may be pertinent.

If the aircraft is located, the destination station shall transmit a cancellation message.

INREQ

The destination station transmits an INREQ message to all stations along the route of flight. The INREQ message should include all information that might assist in search activities. Enroute stations receiving an INREQ shall check facility records and all flight plan area airports along the proposed route of flight. Stations shall reply to the INREQ within 1 hour. When a station is unable to complete the search within 1 hour, the station must forward a status report to the destination station, followed by a final report when the search is complete.

The INREQ originator shall transmit a cancellation message containing the location of the aircraft when the aircraft is located.

ALNOT

The destination station transmits an ALNOT message to the Regional Operations Center, RCC, and those facilities within the search area. The search area is normally the area extending 50 miles on either side of the proposed route of flight from the last reported position to the destination. The search area may be expanded to the maximum range of the aircraft at the request of the RCC or the destination station. Upon receipt of the ALNOT, immediately conduct a communications search of the flight plan area airports that were not checked during the INREQ. Request the appropriate law enforcement agency to check airports that cannot be contacted otherwise. Reply to the ALNOT within 1 hour.

The ALNOT remains current until the aircraft is located or the search is suspended by the RCC. The ALNOT originator shall then transmit a cancellation message with the location of the aircraft, if appropriate.

IFR SAR Procedures

Introduction

ARTCCs assure that SAR procedures are initiated for overdue IFR aircraft. ARTCCs serve as the central point for collecting information, coordinating with the RCC, and conducting a communications search for overdue or missing IFR flights.

NOTE: ARTCCs also ensure that SAR procedures are initiated for overdue or missing SVFR aircraft.

VFR/IFR flights

For search and rescue purposes, ARTCCs consider combination VFR/IFR flights and air-filed IFR flights the same as IFR flights.

Overdue aircraft

Consider an aircraft to be overdue when neither communications nor radar contact can be established with it and 30 minutes have passed since:

- Its ETA over a specified or compulsory reporting point, or at a clearance limit in your area.
- Its clearance void time.

Note: If you have reason to believe that an aircraft is overdue before 30 minutes, take appropriate action immediately.

Overdue aircraft action

If an aircraft is considered overdue in the terminal environment, the terminal facility shall forward pertinent information to the ARTCC. If the aircraft is considered overdue in the enroute environment, the ARTCC shall forward pertinent information to the RCC and issue an ALNOT.

The ALNOT is issued to all centers and Area B communication circuits, generally 50 miles on either side of the route of flight from the last reported position to destination. At the recommendation of the RCC or at your discretion, the ALNOT may be issued to cover the maximum range of the aircraft.

Continued on next page

Responsibility transfer to RCC

The ARTCC will transfer responsibility for further search to the RCC when one of the following occurs:

- Thirty minutes have elapsed after the estimated aircraft fuel exhaustion time.
- The aircraft has not been located within 1 hour after ALNOT issuance.
- The ALNOT search has been completed with negative results.

ALNOT cancellation

The originating ARTCC shall cancel the ALNOT when the aircraft is located or the search is abandoned.

Section D
NOTAMs

Overview

Introduction

This section provides basic coverage of the DoD NOTAM system, format, and components.

In this section

This section covers the following topics:

NOTAM Responsibilities

Purpose and scope

The purpose of the NOTAM system is to provide accurate and timely information to military aviators and flight operations personnel on the establishment of, condition of, or change in any aeronautical facility, service, procedure, or hazard concerning flight operations.

NOTAM responsibility

The DoD NOTAM system is a part of the United States Notice to Airmen System (USNS). The U.S. Air Force provides overall management of the DoD NOTAM system and represents the services to the FAA. The U.S. Navy coordinates with the U.S. Air Force on the development of policies and procedures that govern the use of the NOTAM system.

The responsibility for originating a NOTAM rests with the commanding officer that has jurisdiction over the facility involved. This responsibility includes ensuring that NOTAM issuance is adequate and timely, and that NOTAMs are promptly canceled or posted.

Providing service

Unless a waiver is issued, all military aerodromes must have the NOTAM service required by the *Department of Defense Notice to Airmen (NOTAM) System,* OPNAVINST 3721.20.

Refer to the FLIP (En route) IFR or VFR Supplements to determine whether NOTAM service is provided for a facility. A diamond symbol is used in the supplements to show that NOTAM service is provided.

The timeliness of NOTAM information is critical to the safety of flight operations. The time limit for coordinating, transmitting, and posting NOTAM information is 15 minutes.

NOTE: Normally, a NOTAM should not be in the system over 90 days.

Outages

The NOTAM time guidelines for outages can be found in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Transmission of NOTAMs concerning malfunctions of navigational aids (unscheduled outages) may be delayed 2 hours to allow for rapid repair when weather conditions remain equal to or better than the following:

Continued on next page

Outages (continued)

- Airfields with two or more approach aids: ceiling 3,000 feet, visibility 5 statute miles.
- Airfields with a single approach aid: sky condition scattered, visibility 5 statute miles.

NOTE: More restrictive weather minimums may be imposed at any aviation facility for unique climatology or for other safety considerations. Also, extensions of the 2-hour unscheduled maintenance period is not authorized.

NOTAM criteria

The effectiveness of the DoD NOTAM system depends on the successful elimination of nonessential information. To minimize transmission times and NOTAM summary sizes, the scope of NOTAM criteria is intentionally limited. Specific NOTAM conditions and restrictions are contained in the *DoD Notice to Airmen (NOTAM) System,* OPNAVINST 3721.20. Non-NOTAM information that would not prohibit safe aircraft operation can be disseminated through other means such as ATIS, ATC advisories, and AIRADs.

NOTAM Codes and Format

Introduction

The military uses Q-CODES for the ease of dissemination of NOTAMs. Encoding NOTAMs in this format reduces transmission time over telecommunication channels.

NOTAM code format

The examples that follow will explain the NOTAM code format.

All NOTAM codes contain five letters.

1	2	3	4	5
Q	_	_	_	_

The first letter (always Q) indicates that the next four letters are NOTAM codes.

1	2	3	4	5
Q	**N**	**N**	_	_

The second and third letters identify the subject or components reported upon; for example, NN = TACAN.

1	2	3	4	5
Q	**N**	**N**	**A**	**U**

The fourth and fifth letters denote the status or condition of operation; for example, AU = not available. Therefore, QNNAU is NOTAM code for "TACAN not available."

A complete listing of NOTAM Q-CODES is contained in the *Department of Defense Notice to Airmen (NOTAM) System,* OPNAVINST 3721.20.

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NOTAM code amplification

NOTAM code groups may be amplified as necessary; for example, geographical coordinates, frequencies, runway number, etc. Amplifications should be clear, easily understood, using FLIP abbreviations whenever possible.

Transmitting NOTAMs

The following table describes the three different formats used to transmit NOTAM information:

Format	Use
NOTAMN	A **new** NOTAM sent as conditions warrant
NOTAMR	A **replacement** NOTAM sent to update or correct an existing NOTAM
NOTAMC	A **cancellation** NOTAM sent to cancel an existing NOTAM

NOTAM control log

The NOTAM Control Log, DD Form 2349, tracks the issuance, change, or cancellation of a NOTAM. The DD Form 2349 and the comeback (verification) copies of NOTAMs should be retained for 15 days following the expiration or cancellation of a published NOTAM. *Department of Defense Notice to Airmen (NOTAM),* OPNAVINST 3721.20, contains the procedures for maintaining a NOTAM control log.

NOTAM Receipt

Introduction

As a Navy air traffic controller, you need a working knowledge on what actions to take when updating and receiving NOTAM material.

NOTAM summary

Individual NOTAMs submitted by originators are compiled by the USNS and distributed in theater summaries and hourly updates. The various theater summaries are:

- North America (NAMSUM)
- European (EURSUM)
- Pacific (PACSUM)
- Caribbean and South America (CSASUM)

Summary receipt and posting

Summaries are valid upon receipt. They are normally issued on a daily basis—this may be extended during weekends and holidays. Do not use summaries without using hourly updates. The flight planning dispatcher is expected to complete the following actions within 15 minutes of receiving the summary:

- Verify active base NOTAMs
- Review summary for completeness and clarity
- Remove the old summary and post the new summary

Hourly update receipt and posting

The USNS transmits cumulative hourly updates to keep summary information current. Only the latest update is kept. Do not use updates without the applicable summary. The following actions must be completed within 15 minutes of receipt:

- Verify active base NOTAMs
- Review the update
- remove old update and post the new one

If any portion of the new update is missing or unreadable, do not post it. Do not request reruns of hour updates. Ensure the "NOTAMS NOT CURRENT" sign is posted in place of the hourly update.

CHAPTER 8

GENERAL FLIGHT RULES AND IFR AND SVFR CONTROL PROCEDURES

Overview

Introduction

FAR, Part 91, prescribes the basic flight regulations governing the operation of aircraft within the United States. Any agency concerned with the operation of aircraft, such as the Armed Forces and air carrier companies, may write regulations applicable to its own operations. However, such regulations must not be less restrictive than the minimum requirements as set forth in Part 91. Navy pilots must also comply with *General Flight and Operating Instructions,* OPNAVINST 3710.7, which supplements *FAR,* Part 91.

The majority of military flight directives are patterned after *FARs.* Deviations from established Federal regulations, which have been authorized or prescribed for Navy pilots, are covered in each applicable section.

Flight rules are divided into General Flight Rules and two major categories: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). General flight rules apply to all aircraft operations. Visual flight rules are additional rules governing the operation of aircraft in weather conditions that permit the pilot to see-and-avoid other aircraft. Instrument flight rules are also additional to general flight rules. However, IFR regulate the flight of aircraft in weather conditions that do not permit VFR flight. While operating aircraft in the United States, pilots must adhere to general flight rules and applicable portions of VFR and IFR.

Over the high seas, aircraft (military and civilian) of United States registry must comply with still another set of rules. These rules, outlined in Annex 2 of the International Civil Aviation Organization (ICAO), are international in nature. Most countries of the free world comply with the procedures in Annex 2.

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Objectives

The material in this chapter will enable you to:

- Recognize those general flight rules that govern the operation of aircraft as prescribed in *FAR,* Part 91, and OPNAVINST 3710.7.
- Recognize visual flight rules that govern the operation of aircraft.
- Recognize instrument flight rules that govern the operation of aircraft.
- State the rules aircraft must follow when entering Air Defense Identification Zones (ADIZ).
- Identify the control procedures specified for IFR traffic control
- State ATC aircraft vertical separation standards
- Identify Special Visual Flight Rules and other special related procedures.

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
ADIZ	Air defense identification zone
DEWIZ	Distant early warning identification zone
DoD	Department of Defense
DVFR	Defense visual flight rules
FAR	Federal aviation regulation
FL	Flight level
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules

Continued on next page

Acronyms (continued)

Table continued from page 8-2.

Acronym	Meaning
KIAS	Knots indicated airspeed
MCA	Minimum crossing altitude
MEA	Minimum enroute altitude
mi	Mile
MOCA	Minimum obstruction clearance altitude
NAVAID	Navigational aid
nm	Nautical mile
RVR	Runway visual range
RVV	Runway visibility value
VFR	Visual flight rules

Topics

This chapter is divided into four sections:

Section A
General Flight Rules

Overview

Introduction

The most commonly used flying regulations are general flight rules. Both FAA and military directives begin by presenting general flight rules and requirements that apply to the operation of an aircraft in the air and on the ground. *NATOPS General Flight and Operating Instructions,* OPNAVINST 3710.7, is patterned after civil directives. In some cases, this OPNAVINST places greater restrictions on the operation of Navy aircraft than those placed by the FAA on civil aircraft.

An aircraft must be operated at all times in compliance with general flight rules and also in compliance with either visual flight rules or instrument flight rules.

In this section

This sections covers the following topics:

Right-of-Way Rules

Introduction

Every state has right-of-way rules for automobiles such as those rules used at major intersections and traffic hubs. Aircraft have similar rules.

FAR rules

Whether a flight is conducted under IFR or VFR, each person operating the aircraft must be alert to see and avoid other aircraft despite the weather conditions.

FAR, Part 91, makes it very clear who has the right-of-way. The following five right-of-way rules involve situations in which pilots are likely to become involved:

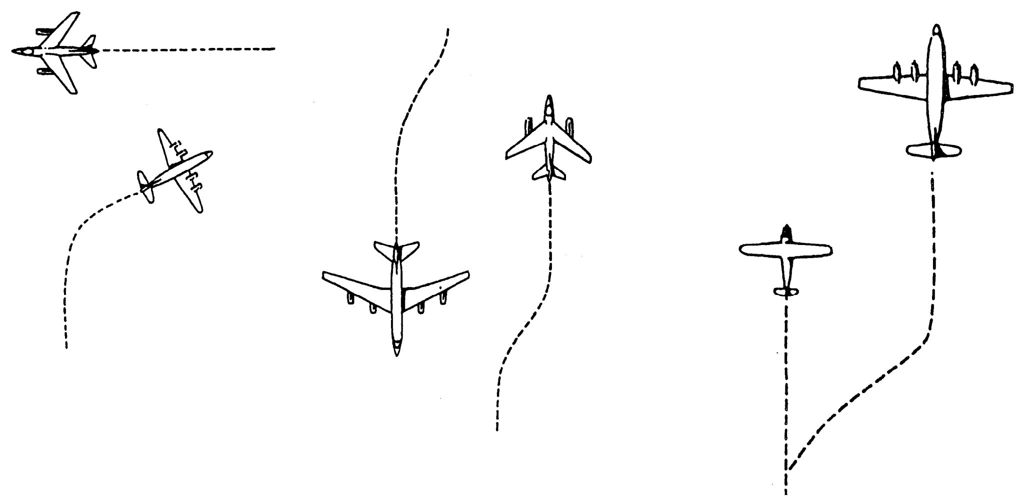
Rule	Explanation
Distress	An aircraft in distress has the right-of-way over all other aircraft.
Converging	Converging aircraft have priority in the following order: (1) balloons, (2) gliders, (3) aircraft towing or refueling other aircraft, (4) airships (blimps), and (5) rotorcraft and fixed-wing aircraft. Like priorities for ships, the least maneuverable aircraft always have the right-of-way. If two or more aircraft of the same category are converging at about the same altitude, the aircraft on the right has the right-of-way.
Approaching head-on	When two aircraft are approaching head on, or nearly so, each pilot should alter his or her course to the right.

Continued on next page

Rules (continued)

Table continued from page 8-A-2.

Rule	Explanation
Overtaking	An aircraft that is being overtaken has the right-of-way. The aircraft that is doing the overtaking, whether climbing, descending, or in level flight, should alter its course to the right to avoid the other aircraft. The aircraft doing the passing is responsible for avoiding a collision.
Landing	An aircraft on final approach or an aircraft in the process of landing has the right-of-way over other aircraft in flight or operating on the surface. When two or more aircraft are approaching for a landing, the aircraft at the lower altitude has the right-of-way.



Converging Approaching Overtaking

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Navy rules concerning converging with formations

In addition to the five right-of-way rules above, Navy pilots have another rule to follow. When a single naval aircraft is converging with a formation of aircraft at about the same altitude (except head-on, or nearly so) the formation flight has the right-of-way. In other cases, the formation is considered as a single aircraft and the *FAR,* Part 91, right-of-way rules above apply.

Formation Flights

Introduction

Many Navy missions require aircraft to fly in formation. As a Navy controller you should be familiar with some of the general guidelines concerning these type flights.

General

Formation flying is authorized only for units and types of aircraft for which a valid requirement exists. Local commanders issue specific instructions and standard operating procedures that must be adhered to by each pilot who is engaged in formation flying.

Formation flight leader responsibilities

The formation leader must file one flight plan for the entire flight and sign the flight plan form as pilot in command. Additional formation flight leader responsibilities can be found in *NATOPS General Flight and Operating Instructions,* OPNAVINST 3710.7.

Formation takeoffs and flight

Section takeoffs for fixed-wing aircraft of similar performance are authorized only for units and types of aircraft whose military missions require formation flying, including pilot training. Lateral separation for minimum interval takeoff must be the separation specified in the local directive for section takeoffs.

In instrument conditions, two-plane formation flight is authorized provided the weather (ceiling and visibility) is at or above the published circling minimums for the runway in use. When a circling approach is not authorized, ceiling and visibility must be at least 1,000 feet and 3 statute miles.

Aircraft Speed and Lighting

Introduction

To reduce the midair collision hazard associated with high aircraft speeds at low altitudes, the FAA imposes speed limits. The FAA also imposes aircraft position lighting and aircraft anticollision lighting requirements. Compliance with aircraft speed and lighting is critically important when aircraft operate in close proximity.

Aircraft speed limits

FAR, Part 91, imposes the following a maximum airspeed limitations:

Aircraft Operating Altitude and Proximity to Controlled Airspace	Maximum Speed Limit
Below 10,000 ft MSL	250 KIAS
Below 2,500 ft above the surface within 4 nm of a primary airport in a Class B, C, or D airspace area	200 KIAS
Airspace underlying a Class B airspace area	200 KIAS

Exceptions to aircraft speed limits

The regulation grants exception for operations that cannot safely be conducted at airspeeds less than the prescribed maximum airspeed. For example, the FAA has authorized the DoD to exceed 250 KIAS below 10,000 feet MSL for operations within restricted areas or military operations areas and on mutually developed and published routes such as military training routes.

If the airspeed required or recommended in the aircraft NATOPS manual to maintain safe maneuverability is greater than the maximum speeds, the aircraft may be operated at that speed. However, the pilot must notify the ATCF of that higher speed.

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Aircraft lighting requirements

Aircraft position and anticollision lights are required to be lighted on aircraft operated from sunset to sunrise.

Anticollision lights need not be lighted when the pilot in command determines that, because of operating conditions, it would be in the interest of safety to turn off the lights. For example, the pilot should turn off strobe lights on the ground when they adversely affect ground personnel or other pilots. He or she should also turn off these lights in-flight when there is adverse reflection from clouds.

Minimum Safe Altitudes

Introduction

Minimum safe altitudes are published for emergency use on instrument approach procedure charts. These altitudes are specified in *FAR,* Part 91, for various aircraft operations.

Minimum safe altitudes

Minimum safe altitudes are depicted on approach charts and provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes are identified as minimum sector altitudes or emergency safe altitudes.

Minimum sector altitudes

Minimum sector altitudes provide at least 1,000 feet of obstacle clearance within a 25-mile radius of the navigation facility upon which the procedure is predicated. Sectors depicted on approach charts must be at least 90 degrees in scope. These altitudes are for emergency use only and do not necessarily assure acceptable navigational signal coverage.

Emergency safe altitudes

Emergency safe altitudes provide at least 1,000 feet of obstacle clearance in nonmountainous areas and 2,000 feet of obstacle clearance in designated mountainous areas within a 100-mile radius of the navigation facility upon which the procedure is predicated and normally used only in military procedures. These procedures are identified on published procedures as "Emergency Safe Altitudes."

Altimeter Settings

Introduction

Altimeter settings are critical to flight safety and, as an air traffic controller, you must know the rules that apply.

Settings

Pilots are required to maintain their aircraft's cruising altitude or flight level, as the case may be, by reference to an altimeter that he or she sets as follows:

Altitude	Setting
Below 18,000 feet MSL	To the current reported altimeter setting for a station along the route of flight and within 100 nautical miles of the aircraft. If there is no station within the area prescribed above, then to the current altimeter setting of an appropriate available station. If the aircraft is not radio-equipped, the pilot must use the altimeter setting for the departure airport.
At or above 18,000 feet MSL	All altimeters must be set to 29.92 inches.

NOTE: In some overseas areas, the transition altitude may not be 18,000 feet.

Deviation from *FAR*, Part 91, Rules

Introduction

The rules in *FAR*, Part 91, apply to pilots operating aircraft anywhere in the United States, its territories, and its possessions. This includes the territorial waters and the overlying airspace of these areas. We use overlying airspace here to mean the airspace extending from the surface up to the maximum altitude limits of aircraft.

There are some exceptions which allow pilots to deviate from these rules. Exceptions include

- an emergency
- when a military necessity exists
- when the FAA administrator grants a waiver of these rules.

Emergency action

In an emergency requiring immediate action, the pilot in command may deviate from any rule to the extent required to meet that emergency. However, the pilot must, upon the request of the FAA administrator, make a written report of the deviation.

Military necessity

Some of our military pilots have the responsibility of defending our country. There are times when a fighter pilot may need to fly his aircraft in a way that conflicts with the rules of *FAR*, Part 91. On these occasions, there may not be enough time for military authorities to request a waiver of the rules. Therefore, the pilot may deviate from *FAR*, Part 91, when military authorities determine that a military necessity exists. A military necessity might be the interception of an unknown aircraft by an air defense pilot who must identify the aircraft as friendly or hostile.

FAA waiver

Another case when deviation from *FAR*, Part 91, may be allowed is when military or civilian pilots are engaged in special flight operations that necessarily conflict with the regulations. Air shows, air races, acrobatic flights, seeding operations, and crop-dusting are examples of special flight operations. In these cases, the pilot must obtain a waiver before deviating from the rules. The FAA administrator may issue a **Certificate of Waiver** authorizing the operation of aircraft in deviation of any rule set forth in *FAR*, Part 91, if he or she determines that the operation can be safely conducted. Applications for a Certificate of Waiver may be submitted to any FAA office.

Compliance with ATC Instructions

Introduction

An ATC clearance is issued for the purpose of preventing collision between known aircraft and in the interest of safety must be complied with. However, there may be cases where a pilot must deviate from an ATC clearance.

Clearances and compliance

An ATC clearance does not constitute authority for a pilot to violate any provision of the *FAR.* The pilot is still the final authority where the operation of the aircraft is concerned and may, therefore, in an emergency deviate from either an ATC clearance or instruction. To confirm this, Part 91.75 of the *FAR* states, in part, "(b) Except in an emergency, no person may, in an area in which air traffic control is exercised, operate an aircraft contrary to an ATC instruction. Each pilot in command who deviates, in an emergency, from an ATC clearance or instruction shall notify ATC of that deviation as soon as possible." If the deviation was the result of an emergency situation that required air traffic control priority, the pilot must, if requested by ATC, submit a detailed report of the emergency to that ATC facility within 48 hours.

An alleged violation of flying regulations by Navy pilots falls within the purview of *U.S. Navy Regulations.* Therefore, the required investigation and reports are the responsibility of the commanding officer of the pilot concerned. The procedures for investigating and reporting flight violations are contained in *NATOPS General Flight and Operating Instructions,* OPNAVINST, 3710.7.

Airport Operations

Introduction

Unless otherwise authorized or required by ATC, no person may operate an aircraft within Class D airspace except to land at or takeoff from an airport within that area. ATC authorizations may be given as specific approval of specific operations or may be contained in written agreements between airport users and the tower concerned.

Communication

The pilot must establish and maintain two-way radio communications with the ATC facility concerned and monitor emergency frequencies. Aircraft operating to, from, or on an airport with an operating control tower must comply with instructions received from that control tower or other ATC facility having control jurisdiction.

Minimum altitudes

Unless otherwise required by local procedures, by ATC instructions, or by applicable distance-from-cloud criteria, turbine-powered aircraft or large aircraft must enter Class D airspace at an altitude of at least 1,500 AGL. They are also required to maintain at least 1,500 AGL until further descent is required for a safe landing.

When a large or turbine-powered aircraft departs, it is required to climb to an altitude of 1,500 feet AGL as rapidly as practicable.

Traffic patterns

At airfields with an operating control tower, all traffic circles the runway to the left, unless instructed otherwise.

At airfields without an operating control tower, all traffic circles the runway to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right.

Helicopters are to avoid the flow of fixed-wing aircraft and, within a Class B, C, or D airspace area, must not exceed 500 feet AGL unless specifically cleared by the control tower.

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Taxi, takeoff, and landing clearance	A clearance must be received before an aircraft may taxi, takeoff, or land. When you give an aircraft a clearance to "taxi to" a specific runway, you have given your approval to cross all intersecting runways. The pilot must obtain approval prior to moving on to the departure runway.
Hold short	Aircraft ready for takeoff will hold short of the active runway at established holding points marked by hold lines and hold signs. When an airfield does not have hold lines or hold signs, you must instruct the aircraft to hold short of a specific runway and issue traffic information as necessary. Navy pilots are required to read back all "position and hold" and "hold short" instructions.
Wheels down	Arriving Navy aircraft are required to give a wheels down report as the aircraft turns on to the base leg or after lowering the landing gear on a straight-in approach. If this report is not received, you are required to remind the pilot to "check wheels down" at an appropriate position in the pattern if the report is not given.
Aircraft on the ground during an emergency	When the tower is controlling an aircraft in an emergency, aircraft on the ground must taxi clear of the runway. Those on the taxiway must hold until authorized to proceed. Pilots of taxiing aircraft sighting emergency vehicles displaying flashing red lights on the field must stop and hold their positions until authorized to proceed.

Additional General Flight Rules

Introduction

The Navy has adopted some additional general flight rules to cover the operation of its aircraft. The following general flight rules are contained in OPNAVINST 3710.7.

Class B, C, or D airspace areas

OPNAVINST 3710.7 states, "Navy pilots shall not perform or request clearance to perform unusual maneuvers in the vicinity of an airport within a Class B, C, or D airspace area if such maneuvers are not essential to the performance of the flight." Additionally, Navy air traffic controllers are not permitted to approve a pilot's request or ask a pilot to perform these maneuvers.

Simulated flight operations

Simulation, or the practice of procedures, is a very necessary thing, and you as a controller should always be alert for a pilot's request to perform simulated operations.

Pilots who conduct simulated instrument flights sometimes use hoods which restrict their view to the aircraft's instruments. This procedure is especially challenging because the pilots cannot see outside the aircraft's cockpit. Thus, the following general rules must be complied with:

- Approval is obtained from the appropriate facility before simulated instrument approaches are conducted.
- For single-piloted aircraft, a chase plane is used.
- For multipiloted aircraft, a chase plane is used unless adequate cockpit visual lookout, as defined in OPNAVINST 3710.7, can be maintained.

Continued on next page

Simulated flight operations (continued)

- Navy pilots of single-piloted aircraft may not use a hood below 1,000 feet AGL except when making a precision approach. When making a precision approach, using either radar or other similar NAVAID, these pilots may use a vision-restricting device down to 500 feet AGL. In multipiloted aircraft, a hood may be used by one pilot for simulated instrument takeoffs and down to published minimums for the approach being flown provided the other pilot is qualified in the aircraft being flown.

The need for pilots to practice the procedures to deal with inflight emergencies is obvious. You must cooperate with them the best you can when requests are made to conduct simulated emergency operations.

Section B
Visual Flight Rules

Overview

Introduction

A pilot operating as prescribed by visual flight rules (VFR) is flying according to the see-and-avoid concept. Simply defined, this means a pilot is responsible for his or her own separation from other aircraft under most circumstances.

In this section

This section covers the following topics:

Basic VFR Weather Minimums

Introduction

Minimum weather conditions are exactly that—minimum. While flying in weather conditions equal to or better than those required for VFR flight, the pilot has the primary responsibility of avoiding a collision.

A flight in minimum or near-minimum weather conditions is only undertaken on a VFR clearance when absolutely necessary. However, pilots sometimes fly VFR in these conditions, and it is during these times when you must be extremely alert.

Cloud and visibility clearance requirements

The minimum distance from clouds and visibility requirements that a pilot must maintain during VFR flight depends upon

- airspace classification
- altitude
- whether the flight is conducted during night or day

The following tables list the VFR clearance from cloud and visibility requirements:

Airspace Class	VFR Weather Minimums	
	Flight Visibility	**Distance from Clouds**
A	NA	NA
B	3 statute mi	Clear of clouds
C	3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal
D	3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal

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Basic VFR Weather Minimums, Continued

Cloud and visibility clearance requirements (continued)

Table continued from page 8-B-2.

Airspace Class	VFR Weather Minimums	
	Flight Visibility	**Distance from Clouds**
E	**Less than 10,000 ft** MSL—3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal
	At or above 10,000 ft MSL—5 statute mi	1,000 ft below 1,000 ft above 1 statute mi horizontal
G	**1,200 ft or less above the surface (regardless of MSL altitude)—** *Day—1* statute mi *Night*—3 statute mi	Clear of clouds 500 ft below 1,000 ft above 2,000 ft horizontal
	More than 1,200 ft above the surface but less than 10,000 ft MSL— *Day*—1 statute mi *Night*—3 statute mi	500 ft below 1,000 ft above 2,000 ft horizontal 500 ft below 1,000 ft above 2,000 ft horizontal

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Basic VFR Weather Minimums, Continued

Cloud and visibility clearance requirements (continued)

Table continued from page 8-B-3.

Airspace Class	VFR Weather Minimums	
	Flight Visibility	**Distance from Clouds**
G	**More than 1,200 ft above the surface and at or above 10,000 ft MSL**—5 statute mi	1,000 ft below 1,000 ft above 1 statute mi horizontal

Weather conditions precluding VFR flight

When weather conditions encountered en route preclude compliance with VFR rules, a pilot can be expected to do one of the following:

- Alter the route of flight so as to be able to continue under VFR conditions
- Remain in VFR conditions until he or she can file a change of flight plan from the air and obtain an IFR clearance
- Remain VFR and land at an alternate airport

Special VFR Operations

Introduction

As an air traffic controller, you must be familiar with SVFR operations and understand what you can and cannot do in these situations and what to expect from the aircraft.

Special visual flight rules (SVFR)

There are exceptions to the VFR weather minimums we have discussed. SVFR operations in weather conditions less than basic VFR minima may be conducted under the following conditions:

- SVFR flights must remain clear of clouds.
- SVFR operations may be conducted within the lateral boundaries of Class D and E surface areas and some Class B and C surface areas below 10,000 feet MSL.
- A SVFR clearance must be requested by the pilot.
- Weather conditions used for determining approval or disapproval of a SVFR request are based on the weather reported at the airport of intended landing or departure.
- IFR traffic will not be unduly delayed because of the operation.
- Helicopters can operate in Class B, C, D, and E surface areas with less than 1 statute mile visibility.

Do not assign a fixed altitude when applying vertical separation. Rather clear SVFR aircraft at or below an altitude that is at least 500 feet below conflicting IFR traffic but not below the minimum safe altitude as prescribed in *FAR,* Part 91.

VFR Cruising Altitudes

Introduction

There are cruising altitudes that apply to both VFR and IFR operations, and they apply to flight in both controlled and uncontrolled airspace. At this point, we are dealing only with VFR cruising altitudes.

Cruising altitudes for VFR aircraft

The following tables list the appropriate altitudes for VFR flights based on direction of flight:

More than 3,000 feet above the surface up to and including FL290

Magnetic course	VFR cruising altitude
0-179	Odd cardinal altitudes plus 500 feet (e.g., 3,500, 5,500, FL195, FL275, etc.)
180-359	Even cardinal altitudes plus 500 feet (e.g., 4,500, 8,500, FL205, FL285, etc.)

Above FL290

Magnetic course	VFR cruising altitude
0-179	4,000-foot intervals starting with FL300 (e.g., FL300, FL340, FL380, etc.)
180-359	4,000-foot intervals starting with FL320 (e.g., FL320, FL360, FL400, etc.)

VFR cruising altitude separation

There are two distinct separation points in the structure of the separation system. The first point is at 3,000 feet AGL where cruising altitudes start; the second point is at flight level 290 (29,000 feet) where vertical separation increases.

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VFR cruising altitude separation (continued)

- From 3,000 feet to flight level 290, opposite-direction traffic is separated vertically by 1,000 feet.
- Above flight level 290, opposite-direction traffic is separated vertically by 2,000 feet.

Separation of 1,000 and 2,000 feet may sound like more separation than is needed, but sandwiched in between VFR cruising traffic is IFR cruising traffic.

Cruising altitude selection

Two things need to be considered to determine a proper cruising altitude for VFR aircraft

- The magnetic direction of intended flight
- The desired altitude of the flight.

Taking these two items into account, we select the proper cruising altitude. To illustrate, you can select a cruising altitude closest to 8,000 feet that would be appropriate for a magnetic course of 110°. Since 110° falls between 0° and 179°, you should select 7,500 feet as the closest east-bound VFR cruising altitude to the desired altitude of 8,000 feet. The next closest cruising altitude for this direction of flight is 9,500 feet. Traffic in the other direction, west-bound or 180° through 359°, adheres to the standard of **even** thousands plus 500.

Cruising altitudes above FL290 drop the plus 500 addition and advance to the added separation factor. Notice that between 0° and 179° any flight level beginning at FL300 at 4,000-foot intervals is appropriate. Between 180° and 359° any flight level at 4,000-foot intervals starting at FL320 is appropriate.

Exemptions from VFR cruising altitudes

A VFR aircraft is exempt from complying with cruising altitudes when the aircraft is in one of the following situations:

- Flying at or below 3,000 feet AGL
- In a holding pattern with 2-minute legs or less
- In a turn

Section C
Instrument Flight Rules

Overview

Introduction

The effectiveness of Navy pilots depends largely upon their ability to operate aircraft in all types of weather conditions. To do this with a reasonable degree of safety, you and the pilot must observe the basic regulations and control procedures that govern IFR flight. Most *FAR,* Part 91, rules apply to both military and civilian operations.

The Navy's express goal to decrease the probability of midair collisions requires that Navy pilots operate under IFR to the maximum extent possible without unacceptable mission degradation. To meet this goal, the Navy has added several additional requirements.

In this section

This section covers the following topics:

Applicability

Introduction

To understand and apply IFR flight rules, you must know where and when these rules apply.

FAR requirement

FAR 91.115 states "No person may operate an aircraft in controlled airspace under IFR unless:

1. An IFR flight plan has been filed, and
2. An appropriate ATC clearance has been received."

IFR compliance

Pilots must comply with IFR procedures when operating their aircraft in weather conditions that are less than VFR minimums. Additionally, Navy pilots are encouraged to use IFR procedures when their flights are conducted within the federal airway system.

Pilots must adhere to IFR procedures in the following situations:

- When conducting flights along jet routes (Operations parallel to and within 10 miles of the established centerline are considered to be along the route.)
- When operating in Class A airspace
- During flights to and from targets or operating areas when feasible
- When performing instrument approaches

When VFR conditions exist, a pilot may waive any of the above four requirements for a specific flight when he or she needs to circumnavigate or otherwise avoid severe weather or when an in-flight emergency dictates such action.

Takeoff Minimums

Introduction

Pilot ceiling and visibility takeoff minimums ensure that a pilot can return to the departure airport and land if an emergency should develop shortly after takeoff. *FAR* 91.116 contains takeoff minimums for civilian airports.

Application of takeoff minimums to Navy pilots

The instrument rating of a Navy pilot determines if he or she is subject to takeoff ceiling and visibility minimums at a naval air station. A pilot's qualifications and experience determine the rating.

A Navy pilot with a standard instrument rating must adhere to ceiling and visibility minimums before he or she requests a takeoff.

A Navy pilot with a special instrument rating has no minimums.

Standard instrument rated pilot takeoff request

A standard instrument rated pilot must observe to the following minimums when he or she requests takeoff:

- A 300-foot ceiling and a l-statute-mile visibility unless the air station has PAR with published minimums less than 300 and 1.
- With PAR, weather must at least be equal to the precision approach minimums for the runway in use. The ceiling cannot be less than 200 feet and visibility cannot be less than 1/2 statute mile or a 2,400-foot RVR.

Special instrument rated pilot takeoff request

A special instrument rated pilot requests takeoff based upon his or her judgment and the urgency of the flight. Special instrument rated pilots have no ceiling or visibility takeoff minimums.

Minimum IFR Altitudes and IFR Cruising Altitudes

Introduction

Except when landing or taking off, an IFR aircraft must maintain an altitude that is no lower than the established minimum IFR altitude for its position. This altitude is the lowest altitude that permits safe flight with regard to the terrain, the weather conditions, and the navigational facilities available. In some cases, the Navy has established additional minimums for its aircraft that are more restrictive than civilian minimums.

Minimum IFR altitudes on airways

Minimum IFR altitudes appear on charts as one of the following data elements:

- Minimum en route IFR altitudes (MEA)
- Minimum obstruction clearance altitude (MOCA)
- Minimum crossing altitude (MCA) (The MCA is the minimum altitude that an aircraft can cross a fix or reporting point along an airway.)

For further information, refer to the *FAR,* Part 91.

No published minimum IFR altitudes

Operations in uncontrolled airspace include operations like point-to-point flight. Uncontrolled airspace does not have published MEAs or MOCAs and the following minimum IFR altitudes apply:

- For Navy aircraft

Areas	Minimum altitude above the highest obstacle within 22 miles of the centerline of an intended course
Over designated mountainous terrain	2,000 ft
Other than mountainous areas	1,000 ft

Continued on next gage

No published minimum IFR altitudes (continued)

- For civilian aircraft

Areas	Minimum altitude above the highest obstacle within 4 miles of the centerline of an intended course
Over designated mountainous terrain	2,000 ft
Other than mountainous areas	1,000 ft

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Minimum IFR Altitudes and IFR Cruising Altitudes, Continued

IFR Altitude assignment

IFR aircraft should be cleared to the appropriate altitudes as depicted in the table below:

Aircraft Operating	On course *degress magnetic*	*Assign*	*Examples*
Below 3,000 feet above surface	Any course	Any altitude	
Below FL 290	0 through 179	Odd cardinal altitude or flight levels at intervals of 2,000 feet	3,000 5,000, FL250, F270
	180 through 359	Even cardinal altitude or flight levels at intervals of 2,000 feet	4,000, 6,000, FL240, FL 260
At or above FL 290	0 through 179	Odd cardinal flight levels at intervals of 4,000 feet beginning with FL 290	FL290, FL330, FL370
	180 through 359	Odd cardinal flight levels at intervals of 4,000 feet beginning with FL 310	FL310, FL350, FL390

Aircraft Operating	*On course degrees magnetic*	*Assign*	*Examples*
One way routes (except in composite systems)	Any course	Any cardinal altitude or flight level below FL 290 or any odd cardinal flight level at or above FL 290	FL270, FL280, FL310, FL330
Within an ALTRV	Any course	Any altitude or flight level	
In transition to/from or within Oceanic airspace where composite separation is authorized	Any course	Any odd or even cardinal flight level including those above FL 290	Fl280, FL290, FL300, FL310, FL320, FL330, FL340
In aerial refueling tracks and anchors	Any course	Altitude blocks as requested. Any altitude or flight level	050B080, FL180B220, Fl280B310

Landing Minimums

Introduction	Instrument approach procedures and landing minimums are published in DoD flight information publications (terminal) or other similar publications. You should understand approach procedures and the minimums for your airfield.
Ceiling and visibility	The absolute minima for a single-piloted Navy aircraft executing a precision approach is a 200-foot ceiling with 1/2-mile visibility (2,400-foot RVR) or published minima, whichever is higher. An entire airfield is below minimums when the existing visibility is lower than the lowest published visibility for an operative navigation or approach aid. An airport's prevailing visibility is the controlling factor for approaches that require an aircraft to circle to another runway. Prevailing visibility also controls straight-in approaches when RVR or RVV information is not available.
At or above minimums before starting approach	A pilot is permitted to start an approach (or a high-altitude penetration for an approach) when the reported terminal weather indicates that existing ceiling and visibility are at or above the published approach minimums.
Below minimums before starting approach	Normally, the pilot will request clearance to a holding fix or clearance to an alternate airport when the weather is below minimums. A multipiloted Navy aircraft may begin an approach after receiving a weather report that below minimum weather conditions exist provided the aircraft can proceed to a suitable alternate airport in the event of a missed approach.
Below minimums during approach	When a pilot began the approach or penetration before obtaining the necessary weather information, he or she may continue the approach to the missed approach point. If the pilot sights the runway, approach lights, etc., he or she may proceed to land. **NOTE:** Determination that existing weather or visibility is adequate for approach or landing is the responsibility of the pilot.

ATC IFR Clearance

Introduction

A pilot must receive an IFR clearance before flying IFR in controlled airspace. The clearance is given by the ATC facility having IFR authority over the airspace in which the flight is to be conducted.

Required items of a clearance

The required items of an IFR clearance are as follows:

- Aircraft's identification
- A clearance limit
- The departure procedure or SID
- Route of flight
- Altitude data (in the order to be flown)
- Holding instructions, if necessary
- Special information, if any
- Radio frequency assignment
- Radar beacon code assignment

Deviations from a clearance

Once the pilot requests and receives an IFR clearance, that pilot may not deviate from this clearance without permission. If a deviation is needed or made for emergency reasons, the pilot must notify the controlling agency as soon as possible. The agency then issues another clearance or amends the original clearance. Nothing, however, prevents a pilot from canceling the IFR clearance and proceeding under VFR.

Section D
Security Control of Air Traffic (FAR, Part 99)

Overview

Introduction

FAR, Part 99, prescribes rules for operating aircraft in a defense area, or into, within, or out of the United States through an ADIZ.

In this section

This section covers the following topic:

Security Control of Air Traffic

Introduction

National security in the control of air traffic is governed by *FAR,* Part 99, and *Security Control of Air Traffic and Air Navigation Aids (SCATANA),* OPNAVINST 3722.30, for the Navy. All aircraft entering domestic U.S. airspace from points outside, must provide for identification before entry. To facilitate early aircraft identification of all aircraft in the vicinity of the United States and its international airspace boundaries, ADIZs have been established. Pilots of aircraft must follow specific operational requirements when entering an ADIZ.

Flight Plan

A flight plan must be on file in all ADIZ and DEWIZ areas. The flight plan may be either IFR or DVFR. In some cases, the flight plan must be approved by you, an air traffic controller, before departure. An air filed VFR flight plan makes an aircraft subject to interception for positive identification. Therefore, pilots are urged to file the required DVFR flight plan either in person or by telephone before departure.

Two-way radio

An operative, two-way radio must be available in all ADIZ and DEWIZ areas. If an aircraft is operating on a DVFR flight plan and two-way radio communications cannot be maintained, the pilot may proceed according to the original DVFR flight plan or land as soon as possible. Either way, the pilot must report the radio failure to an appropriate aeronautical facility as soon as possible.

If an aircraft is operating within an ADIZ or DEWIZ under an IFR flight plan and two-way communications cannot be maintained, the pilot will proceed in accordance with *FAR,* Part 91.

Position reporting

Normal IFR position reports are required in all ADIZ and DEWIZ areas. In the domestic and coastal ADIZ areas, flight under DVFR flight plans must give the estimated time of ADIZ penetration at least 15 minutes before penetration. In the coastal ADIZ, inbound foreign aircraft must report at least 1 hour before ADIZ penetration.

Continued on next page

Aircraft position tolerances

Estimated points and times of ADIZ penetration are just that-estimates. Thus, some tolerances are allowed.

Over land, the tolerance is ±5 minutes from the estimated time over a reporting point or point of penetration and within 10 nautical miles from the centerline of an intended track over an estimated reporting point or point of penetration.

Over water, the tolerance is ±5 minutes from the estimated time over a reporting point or point of penetration and within 20 nautical miles from the centerline of the intended track over an estimated reporting point or point of penetration.

Exemptions

Aircraft operating within an ADIZ may be exempted from the national security requirements of *FAR,* Part 99 (except for special security instructions issued by the administrator in the interest of national security), if the aircraft is operating in the following:

- Within the 48 contiguous states and the District of Columbia, or within Alaska, and remains within 10 miles of the departure station
- Any ADIZ other than the contiguous U.S. ADIZ when the aircraft's true airspeed is less than 180 knots
- Over or within 3 nm of the coastline of any island in the Hawaiian Coastal ADIZ

NOTE: Locally, the ARTCC can authorize deviations from *FAR,* Part 99, for some ADIZ operations.

CHAPTER 9

CONTROL TOWER OPERATIONS

Overview

Introduction

At any location where terminal air traffic control (ATC) operations are conducted, the control tower is the hub of the ATC complex. From this hub all clearances for landings and takeoffs originate. This is the case even though the aircraft may be under the direct control of a radar approach control or ground controlled approach (GCA) facility. The tower local controller is the final authority in determining the use of the runway. When both VFR and IFR air traffic are arriving and departing, the tower controller takes and coordinates actions needed to blend these operations into an orderly flow of traffic.

Your job as the air traffic controller is to effect the safe, orderly movement of aircraft. You must also control vehicular and pedestrian traffic on the airfield. To do these jobs, you use radios and other signaling devices to provide information and instructions relative to the traffic and airport conditions.

This chapter introduces you to the primary duties of a tower controller and to the control procedures you must use.

Objectives

The material in this chapter will enable you to:

- Identify the operating positions in a basic control tower
- Identify responsibilities of control tower personnel for each operating position
- Identify general procedures applicable to control tower operations
- Identify the component parts of standard traffic patterns
- State the landing and sequencing information given to pilots
- State those procedures that pertain to special operations

Continued on next page

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
AC	Navy air traffic controller
ATC	Air traffic control
ATIS	Automatic terminal information service
CARF	Central altitude reservation function
CD	Clearance delivery position
CTO	Control tower operator
FAA	Federal Aviation Administration
FCLP	Field carrier landing practice
FD	Flight data position
FDIO	Flight data input/output
GC	Ground controller
GCA	Ground-controlled approach
IFR	Instrument flight rules
LC	Local controller
LSO	Landing signal officer
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to airmen
SAFI	Semiautomatic flight inspection
SAR	Search and rescue
SVFR	Special visual flight rules

Continued on next page

Acronyms (continued)

Table continued from page 9-2.

Acronym	Meaning
USAF	U.S. Air Force
VFR	Visual flight rules

Topics

This chapter is divided into four sections:

Section A
Tower Operating Positions and Responsibilities

Overview

Introduction

This section covers the operating procedures and responsibilities of control tower personnel. This is basic information; for more detailed information, refer to *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

In this section

This section covers the following topics:

Control Tower Responsibilities

Introduction

Establishment of controller positions varies according to local requirements and type of facility, but those included in most control towers are the local control position, ground control position, and the flight data position. Clearance delivery may or may not be located in the control tower.

Responsibilities

The hub of airport operations is the control tower. It is elevated to a suitable height to afford the maximum visibility of the airport and the immediate area. The primary objective of the control tower is to promote the safe, orderly, and expeditious movement of air traffic. This includes the following:

- Aiding pilots in preventing collisions between aircraft and between obstructions and aircraft in the movement area
- Expediting and maintaining an orderly flow of air traffic
- Assisting the pilot of an aircraft by providing advice needed for the safe and efficient conduct of the flight
- Notifying appropriate organizations regarding aircraft known or believed to be in need of search and rescue aid and assisting such organizations as required

The control tower exercises control of all aircraft operating on or around an airfield; all movements of aircraft must have prior approval from the control tower. This includes instructions and permission to tow, taxi, takeoff, land, and related aircraft operations.

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Control Tower Responsibilities, Continued

Control tower logs

The control tower log is kept from watch to watch in all Navy control towers. It contains all the pertinent data accumulated during each watch performed in the control tower. A partial listing of the data that is entered in the record or log includes status of equipment, check of communications, status of airport lighting facilities, runway or runways in use, and other information deemed necessary by the control tower chief or tower supervisor.

A position log is also maintained for each operating position in the tower. The purpose of this log is to establish a reliable record of position manning. These logs must contain the date, time, position and controller-operating initials. (If the position is operated by a trainee, his or her initials will be entered after those of the controller responsible for the position.)

Daily and monthly traffic tabulation

To facilitate completion of certain reports required of the ATC division, a daily and monthly tabulation of aircraft operations is needed. Flight progress strips are a main source of traffic count information. These strips are kept for 3 months before they are destroyed. If any strip contains information on an aircraft involved in an accident or emergency, it is kept for a longer period of time. If installed, another source of traffic count information is the Air Traffic Activity Analyzer (ATAA).

A compilation of all operations is submitted annually to the Chief of Naval Operations. This report is referred to as the *Air Traffic Activity Report.* Instructions for completing this report are in the *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Operating Positions

Introduction

Navy control towers require several operating positions. Operating positions may be added, deleted, combined, or integrated as necessary to meet local requirements. Brief descriptions of tower operating positions with their responsibilities follow. Refer to *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114, for more detailed information.

Tower supervisor

The tower supervisor is responsible to the FWS for the operational efficiency of the control tower watch team. The tower supervisor must possess a CTO rating for the control tower to which he or she is assigned. Primary duties of the tower supervisor include the following:

- Coordinating and directing control of aircraft operating in assigned airspace, and coordinating and directing air traffic and surface vehicles operating on runways, taxiways, and other airfield movement areas
- Briefing the control tower watch team on weather conditions, air traffic, equipment status, field conditions, and special evolutions
- Assigning personnel to operating positions according to individual qualifications and training requirements
- Assigning trainees to qualified controllers for supervision and training
- Notifying cognizant SAR agencies of aircraft in distress and providing assistance and advice during emergencies
- When the airfield is technically VFR, but visual separation cannot be maintained, taking immediate action to suspend VFR operations and informing appropriate authorities

Local controller

The LC maintains a continuous visual surveillance of control tower airspace, runways, and other movement areas. Primary duties of the LC include the following:

- Formulating and issuing clearances and control instructions to accomplish separation between aircraft and between aircraft and vehicles operating under the jurisdiction of the tower
- Effecting coordination with appropriate operator positions and other facilities
- Providing flight assistance service to aircraft

Continued on next page

Local controller (continued)

- Operating airport lighting, lighting systems, and visual landing aids
- Initially notifying and dispatching emergency personnel and equipment for aircraft emergencies and accidents.

Ground controller

The GC provides general surveillance of the airport movement area. Primary duties of the GC include the following:

- Formulating and issuing ground movement clearances to aircraft and vehicles operating on the airport
- Transmitting current weather and field conditions as required

Flight data position

The duties of the FD position are as follows:

- Operating interphones and telephones and other communications equipment as needed
- Receiving and relaying aircraft movement data
- Preparing and posting flight progress strips
- Operating ATIS and FDIO equipment
- Monitoring navigational aid alarm systems

Clearance delivery position

The duties of the CD position are as follows:

- Obtaining, posting, and relaying ATC clearances and advisories
- Other duties as assigned by the tower supervisor

Operating position coordination

Operating position coordination involves the use and integration of all available skills and resources to achieve and maintain watch team efficiency, situational awareness, and mission effectiveness. *Air Traffic Control,* FAA Order 7110.65 discusses local controller and ground controller coordination requirements concerning a variety of items.

Section B
General Control Tower Procedures

Overview

Introduction

This section will provide you with information that you will be required to know and utilize as a tower controller. The information is from the *Air Traffic Control,* FAA Order 7110.65, however there are other manuals as well as local procedures that you will also be required to use.

In this section

This section covers information on the following topics:

Advisory Information

Introduction

As a tower controller, you must know when and how to use advisory information to assist the pilot. Advisory information is important because it can make the difference between a safe landing and a tragedy.

As an air traffic controller, you provide ATC service based upon observed or known traffic and airport conditions that might constitute a hazard.

Movement areas

You should issue specific approval or disapproval for movement of vehicles, equipment, or personnel on the movement area via radio or light signal gun.

Conditional phrases

You should *not* qualify approval of specific situations by conditional phrases such as **BEHIND LANDING TRAFFIC,** or **AFTER THE DEPARTING AIRCRAFT.** Personnel can interpret movement instructions with conditional phrases in more than one way. This can cause unsafe movement on the airfield.

Clearances

Air traffic and runway conditions should be the controlling factor in determining whether you deny a clearance to takeoff, to land, to make a low approach, or to make touch-and-go. A closed runway or below weather minimums conditions might also warrant denying a specific aircraft clearance request. However, a landing clearance cannot be withheld indefinitely.

Should a pilot request to use a closed runway, inform the pilot that the runway is closed and, if necessary, quote the appropriate parts of the NOTAM applying to the runway.

Landing gear checks

If a pilot is not sure that the landing gear is down and locked, the pilot must notify the control tower. You then instruct the pilot to perform a low pass in front of the tower for a visual check. Then relay to the pilot the results of the visual check.

Continued on next page

Landing gear checks (continued)

Should any doubt exist after a visual check, alert the crash and rescue equipment and the aircraft pilot. The pilot should then make a precautionary landing. After the landing rollout, the aircraft should not be turned off the runway until ground personnel have made a visual check of the landing gear and installed the gear pins (if applicable).

Unusual maneuvers

Do *not* approve pilot requests or ask a pilot to conduct unusual maneuvers within a control tower's airspace if such maneuvers are not essential to the performance of the flight. These unusual maneuvers include unnecessary low passes, unscheduled fly bys, practice instrument approaches to altitudes below specified minima (unless a landing or touch-and-go is to be made), or any so-called "buzz jobs" wherein flight is conducted at low altitude or a high rate of speed for thrill purposes. Such maneuvers increase hazards to persons and property and contribute to noise complaints.

Bird activity

You should issue bird activity information including position, size, and species (if known), and their course of flight and altitude to pilots of the aircraft concerned for at least 15 minutes after receipt of the information from pilots or adjacent facilities. You may reduce this time when either visual observations or subsequent reports reveal that the bird activity is no longer a factor. Relay bird activity information to adjacent facilities whenever it appears it will become a factor in their areas.

Weather information

You may transmit to pilots or other ATC facilities, without consulting weather service personnel, elements of weather information derived directly from your instruments, from your radar, or received by your tower as a pilot report. You may also transmit observed weather conditions such as LARGE BREAKS IN THE OVERCAST, VISIBILITY LOWERING TO THE SOUTH, or similar statements that do not include specific values. Terminal radar control facilities that provide approach control service to your control tower should inform your tower of storm areas they observe on radar.

Continued on next page

Weather information (continued)

A weather observation that includes specific values (such as ceilings and visibility) must have been made or verified by weather personnel before you transmit it. If you are a certified tower visibility observer and the visibility is less than 4 miles, you may also transmit your visibility observations.

You should inform local weather service personnel of any differences between weather conditions observed from the tower and those reported by weather service.

Field Information

Introduction

The tower controller should issue pertinent field condition information necessary for an aircraft's safe operation in time for it to be useful to the pilot.

Field information

The tower controller must issue the following information concerning field conditions to any pilots concerned:

- Construction work on or immediately adjacent to the movement area
- Rough portions of the movement area
- Braking conditions caused by ice, snow, slush, or water
- Snowdrifts or piles of snow on or along the edges of the area; also the extent of any plowed area
- Parked aircraft on the movement area
- Irregular operation of part or all of the field lighting system
- Volcanic ash on any airport surface and, if known, whether the ash is wet or dry
- Other field conditions considered pertinent by the controller

The tower controller should describe field conditions clearly and concisely.

Runway Use and Conditions

Introduction

The tower controller provides pilots with runway use authorization and runway condition information.

Runway selection

For aircraft operations, you should select the runway most nearly aligned with the wind when the wind velocity is 5 knots or more or the calm-wind runway when the wind velocity is less than 5 knots. An exception to these procedures exists when an airfield has a "runway use" program because of noise abatement or other local restrictions.

You must issue both wind direction and velocity when authorizing the use of runways. You must do this even though the wind velocity is less than 5 knots and the calm wind runway is to be used. Since some aircraft are adversely affected by a tailwind or crosswind component, pilots must be aware of the exact wind condition to conduct a safe flight. Therefore, you should describe the wind condition as "calm" only when the velocity is less than 3 knots.

Use of another runway is permissible if it will be operationally advantageous or if it is requested by a pilot. If a pilot prefers to use a runway different from that which you specify, he or she is expected to advise you accordingly.

Whenever you clear a pilot for operations on other than the advertised active runway, you must state the runway number.

Runway use programs

Runway use programs for large aircraft and turbojet aircraft are set up at some airports. In such programs, runway assignment is affected by consideration of noise-sensitive areas and noise-abatement benefits, not wind velocity. Acceptance or refusal of such assignments is still the pilot's prerogative.

Adverse runway conditions

At facilities affected by winter weather conditions, runway condition and braking action are important information that you must relay to pilots when adverse conditions exist on the landing area.

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Critical phases of flight considerations

The final approach, touchdown, landing roll, takeoff, and initial climb to the first turnaway from the airfield are the most critical phases of flight. These phases require the full attention of the pilot. Except during radar approaches or departures, you must refrain from transmitting to the aircraft during these phases of the operation unless conditions affecting safety of flight exist. You must transmit safety-of-flight considerations, including airfield conditions, at any time you observe them, or they are made known to you.

Priority

Introduction

The normal priority for ATC service is first-come, first-served.

Exceptions to normal

The tower controller should provide first-come, first-served service except for in the following situations:

- Priority to civilian air ambulance flights "LIFEGUARD." Priority to military air evacuation flights when verbally requested. Assist air ambulance or evacuation aircraft to avoid areas of significant weather or turbulent conditions.
- Maximum assistance to SAR aircraft that are performing a SAR mission.
- Expedite the movement of presidential aircraft and entourage and any rescue support aircraft as well as related control messages when traffic conditions and communications facilities permit.
- Special handling, as required, to expedite Flight Check aircraft.
- Expedite movement of NIGHT WATCH aircraft when NAOC is indicated in the remarks section of the flight plan or in air/ground communications.
- Expeditious handling for any civil or military aircraft using the code name FLYNET.
- Expeditious handling of aircraft using the code name "Garden Plot" only when CARF notifies you that such priority is authorized.
- Special handling for USAF aircraft engaged in aerial sampling missions using the code name "SAMP."
- Maximum assistance to expedite the movement of interceptor aircraft on active air defense missions until the unknown aircraft is identified.
- Expedite movement of Special Air Mission aircraft when SCOOT is indicated in the remarks section of the flight plan or in air or ground communications.
- When requested, priority handling to TEAL and NOAA mission aircraft.
- IFR aircraft shall have priority over SVFR aircraft.

Continued on next page

Exceptions to normal (continued)

- Priority and special handling to expedite the movement of OPEN SKIES observation and demonstration flights.
- Aircraft operating under the National Route Program are not subject to route limiting restrictions (i.e., published preferred IFR routes, letter of agreement requirements).

No set priorities can be prescribed for the handling of aircraft experiencing emergencies because of the infinite variety of possible situations that may occur.

NOTE: Aircraft in distress have the right of way over all other traffic.

Section C
Traffic Patterns

Overview

Introduction

Two types of traffic patterns are established at each airfield:

- The standard traffic pattern
- The overhead approach pattern

Normally, traffic patterns provide for left traffic flows; however, right traffic flows are used when required or deemed necessary by the controller and pilot.

In this section

This section covers the following topics:

Standard Traffic Pattern

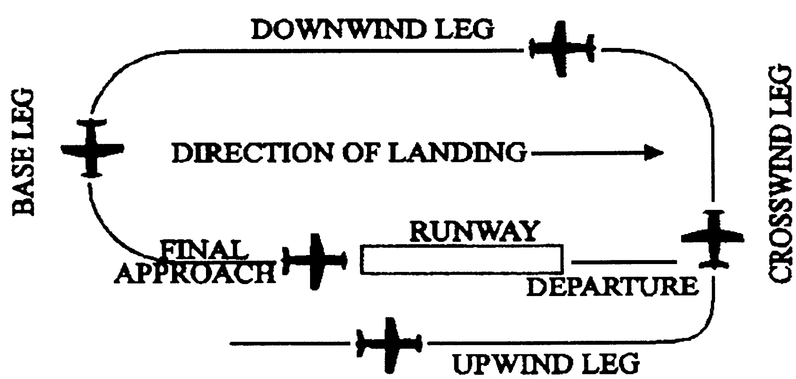
Introduction

The standard traffic pattern is used throughout the Navy. The altitudes for this pattern may vary due to the air station's geographic location or the mission of the aircraft assigned. Additionally, aircraft operational requirements may compel a slight modification to pattern entry procedures. However, the basic pattern parts remain the same.

Under normal conditions, the flow of traffic is counterclockwise, and the pilot makes left turns in the traffic pattern.

Traffic pattern components

The standard traffic pattern components are the upwind leg, the crosswind leg, the downwind leg, the base leg, and the final approach. The traffic pattern components are depicted below.



Traffic pattern component descriptions

A description of each traffic pattern component follows.

UPWIND LEG.—The upwind leg is a flight path parallel to the landing runway in the direction of landing.

CROSSWIND LEG.—The crosswind leg is a flight path at right angles to the landing runway off its upwind end.

Continued on next page

Traffic pattern components descriptions (continued)

DOWNWIND LEG.—The downwind leg is a flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.

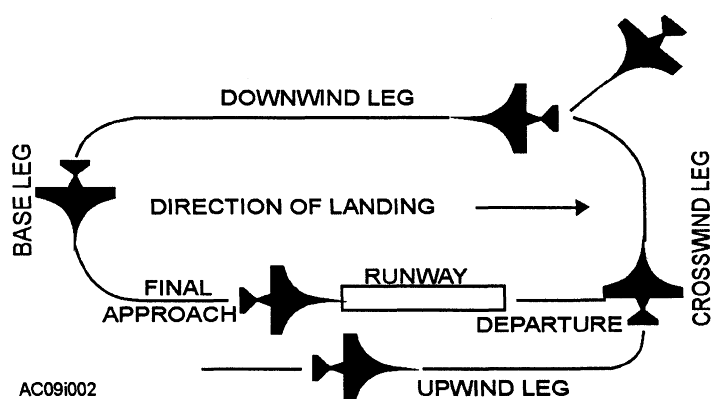
BASE LEG.—The base leg is a flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

FINAL APPROACH.—The final approach is a flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

Downwind entry

Sometimes due to a traffic situation, an emergency, or other aircraft operational requirements, a pilot must perform a downwind entry.

A downwind entry is a pattern entry where the pilot enters the standard traffic pattern at a forty-five degree angle to the downwind leg. A downwind entry is depicted below.



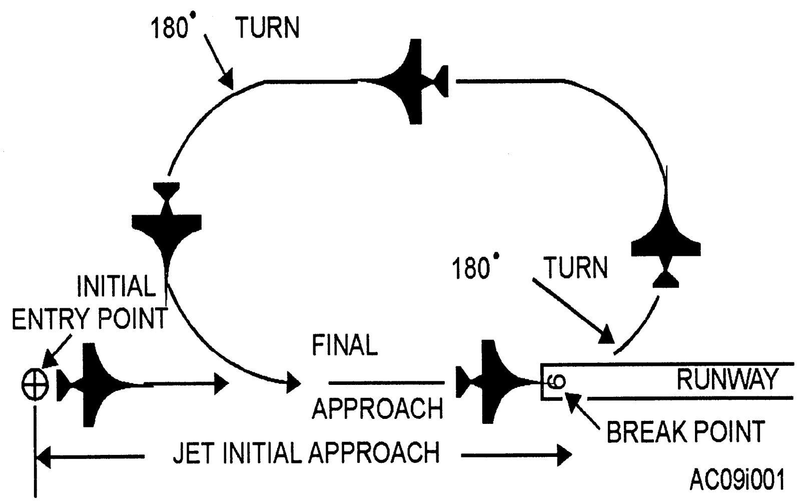
Overhead Approach Pattern

Introduction

The overhead approach pattern is a series of predetermined maneuvers prescribed for VFR arrival of military aircraft (often in formation) for entry into the VFR traffic pattern. This pattern allows high-performance aircraft, such as fighters and certain types of trainers, to transition into the terminal area simultaneously with slower aircraft that are flying a standard traffic pattern.

Overhead approach pattern components

The components of the overhead approach pattern are initial approach, break point, "the 180", and final approach. The overhead approach pattern components are depicted below.



Overhead approach pattern component descriptions

A description of the component parts of the overhead approach pattern follows:

INITIAL APPROACH.—This is a line-of-flight that follows the extended centerline of the landing runway. Initial approach varies in length from 3 to 5 miles. Normally, an aircraft flies the initial approach part of an overhead approach 500 feet above the elevation of the standard traffic pattern for the airfield.

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Overhead approach pattern components descriptions

BREAK POINT.—This is a point, normally just above the landing threshold, where the aircraft is turned (left or right, depending on the direction of traffic flow) 180° so as to be on the downwind leg.

"The 180".—After the downwind leg segment, a second 180° turn is made so as to establish the aircraft on final approach. Up until the time that the second 180° turn is started, the aircraft remains at the traffic pattern altitude.

FINAL APPROACH.—Regardless of the type of aircraft or the type of approach, all arriving aircraft must fly at least one common component of a standard traffic pattern—final approach. Rollout on final approach must not be less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

NOTE: If the pilot does not intend to make a full stop landing from an overhead approach, he or she enters the standard traffic pattern after low approach or touch-and-go.

Visual holding of VFR aircraft

Often, you will need to hold arriving VFR aircraft to adjust the flow of traffic. When this becomes necessary, clear the aircraft to hold at selected, prominent geographical fixes that are easily recognized from the air. If you have more than one aircraft holding at the same fix, issue traffic information.

Issue the following additional landing information to aircraft that will conduct an overhead approach:

- Traffic pattern altitude and direction of turns. You may omit either or both when they are standard or you know that the pilot is familiar with a nonstandard procedure.
- If needed, request the pilot to report the "Initial."
- If required for traffic reasons, request that the pilot report the "Break." Specify the point of break if it is nonstandard or you desire to change the break point for traffic reasons.

Landing Information

Introduction

To ensure a safe and orderly flow of air traffic, you must provide the pilot with certain essential landing information. This information enables the pilot to set up his or her aircraft for the correct VFR traffic pattern entry.

ATIS information

You should provide landing information to arriving aircraft when you establish initial radio contact. You may omit items of information if they are contained in the ATIS broadcast and the arriving pilot states the correct ATIS code.

"Have numbers"

Another procedure you may encounter that greatly reduces frequency congestion is the term *have numbers.* In terminal areas where ATIS is not provided, a pilot may monitor the tower local frequency for enough time before initial contact to determine routine landing information. Upon making initial contact, the pilot will use the term have *numbers* or a similar phrase to indicate that he or she has received the runway, wind, and altimeter setting. Upon hearing the pilot use this term or similar phrase, you may omit these items when issuing landing information. Otherwise, you must issue landing information.

Required landing information

The following information should be relayed to arriving aircraft:

- Specific traffic-pattern information, such as enter left base, enter right base, make straight-in, or make right traffic. This type of information may be omitted if the aircraft is to circle the airport to the left.
- Runway in use.
- Surface wind.
- Altimeter setting.
- Any supplementary information.
- Clearance to land.

Continued on next page

Landing Information, Continued

Required landing information (continued)	• Request for additional position reports. Use prominent geographical fixes which can be easily recognized from the air, preferably those depicted on sectional charts. The legs of the traffic pattern can also be used. Under normal conditions, after landing information has been issued, further communications between the controller and the pilot are not required until the aircraft reports entering the traffic pattern. When the pilot reports entering the pattern, you then sequence the aircraft into the pattern for landing. • Ceiling and visibility if either is below basic VFR minimums. • When available, low-level wind shear advisories. • Braking action for the runway in use received from pilots or the Operations Duty Officer when Braking Action Advisories are in effect.
Wheels-down check	Remind pilots to check for wheels down on the aircraft at an appropriate position in the traffic pattern. The intent is solely to remind the pilot. You may omit this reminder if the pilot reports the aircraft's wheels are down.

Section D
Arrival and Departure Procedures

Overview

Introduction

As a tower controller, you are responsible for arrival and departure sequencing and separation. To do this properly, you must be familiar with the rules and procedures regarding tower separation and sequencing including traffic patterns and runway usage.

The material in this section will not cover all situations. Your facility may have special or unique operations that will be covered in your facility manuals. You should understand and be able to use all the procedures for your field. Not knowing or understanding a procedure while you are controlling usually has a snowball effect that usually has a negative affect on safety.

In this section

This section covers the following topic:

Arrival and Departure Sequencing and Separation

Introduction

Arrival and departure sequencing and separation starts and ends at the runway environment. As a tower controller, you play a vital role in establishing proper separation and sequencing. The rules and procedures that you must follow are contained in *Air Traffic Control,* FAA Order 7110.65. Remember, your facility may have unique procedures that have special requirements that you must also be familiar with. These special requirements are normally published in air operation and facility manuals.

Sequencing and separation criteria

When working in a control tower, you will need to know the sequencing and separation procedures that are outlined in *Air Traffic Control,* FAA Order 7110.65, chapter 3, "Airport Traffic Control."

Objectives

The information in *Air Traffic Control,* FAA Order 7110.65, chapter 3, "Airport Traffic Control" will enable you to:

- State the minimum separation standards between arriving aircraft
- State those procedures that pertain to fixed-winged departures
- State those procedures that pertain to helicopter operations

Section E
Special Operations

Overview

Introduction

Many naval air stations conduct special flight operations required to complete the military training mission. Aerial tow targets and FCLPs are two of these types of operations.

In this section

This section covers the following two topics:

Aerial Tow Target Operations

Introduction

Aerial tow targets and related equipment are used for gunnery practice by ships and shore installations as well as for air-to-air firing exercises in special use airspace.

Towing operations enable gunners to fire at targets that simulate moving aircraft in speed, shape, and maneuvers.

Manual tow target operations

Most aerial tow targets can be released or trailed behind the aircraft in flight and retracted or dropped when the mission is completed. Also, tower pattern and sequencing adjustments may be required during these tow target operations.

Tow target malfunction

If a mechanical malfunction exists, the pilot may not be able to retract the tow target. In such cases, the pilot may decide to make a low approach over the airport and drop the target in an area from which it could be retrieved. The local *Air Operations Manual* designates specific procedures and areas for dropping towed targets.

An aircraft with a tow target in the traffic pattern is a definite hazard and you must control traffic accordingly. You may require additional spacing of traffic or have other traffic vacate the traffic pattern until the tow drop is complete.

FCLP Operations

Introduction

Involvement of the air traffic controller during FCLP operations stems from the AC's responsibility to control aircraft at and around the airport. The AC is called upon to exercise control and to handle other tasks connected with FCLP operations.

FCLPs

Pilots receive an extensive training program at shore installations to prepare them for actual carrier landings. FCLP provides this training. The LSO is in charge of FCLP operations. An LSO is an experienced carrier pilot whom the Navy has designated to assist and instruct pilots in carrier and field carrier landing techniques. The LSO is directly responsible for the aircraft in the FCLP pattern with the local controller maintaining overall responsibility for the separation and sequencing of aircraft in all the tower patterns (FCLP included).

To approximate shipboard landing conditions, simulated flight deck markings are painted on the runway landing area. Lights outline the carrier deck for nighttime use. These lights may be either fixed, portable, or smudge pots.

The FCLP pattern is usually a touch-and-go pattern.

LSO responsibilities during FCLP operations

During FCLP operations, the LSO has the following responsibilities:

- Except when a hazardous condition exists, gives all instructions to the pilots of aircraft in the FCLP pattern.
- In FCLP final approaches, controls aircraft. The LSO may, at his of her discretion, waveoff an aircraft at any point in the landing approach.

Continued on next page

Local controller responsibilities during FCLP operations

The local controller has the following responsibilities during FCLP operations:

- Retains overall control of the all tower pattern traffic (FCLP included)
- Issues instructions to aircraft in the pattern whenever there is danger present to the aircraft
- Sequence and resequence FCLP aircraft and FCLP aircraft and other aircraft as necessary
- Relays information to the LSO pertaining to the aircraft in the pattern if the information will result in safer operations
- Issues takeoff and landing clearances as necessary
- Is alert for emergencies

NOTE: Ground control issues taxiing instructions to FCLP aircraft to proceed to and from the active runway(s).

Tower coordination with the LSO during FCLPs

FCLP operations require the control tower and LSO to perform coordination not normally conducted during normal control tower operations. Some of the additional control tower coordination with the LSO includes informing the LSO of the following:

- When the LSO has a clear deck
- When the FCLP frequency is released to the LSO
- When other than FCLP aircraft are inbound to the FCLP runway
- When FCLP aircraft must enter a DELTA pattern to depart or land nonparticipating FCLP aircraft or for emergency reasons
- During inclement weather or reduced visibility, the need to reduce the number of FCLP aircraft in the pattern and possibly switching to SVFR operations

LSO coordination with the control tower during FCLPs

Some of the coordination the LSO must perform involves informing the control tower:

- When an aircraft will depart the FCLP pattern and reenter from the initial
- When a FCLP aircraft will make a full stop landing

Continued on next page

Tower and LSO coordination during FCLPs (continued)

- When a FCLP aircraft is experiencing an emergency and any assistance required
- The total number of touch-and-goes and waveoffs performed by FCLP aircraft

NOTE: During nighttime FCLPs, normally the carrier deck lighting is turned on and the runway edge lights are turned off except for takeoffs and landings. Therefore, when the control tower is informed an FCLP aircraft is a full stop, the runway edge light must be energized.

A Navy airfield's *Air Operations Manual* and an ATCF's facility manual and directives normally contain the air station unique FCLP coordination requirements.

Intensity settings for optical landing systems

The intensity settings for optical landing systems are critical to the pilots ability to make successful landings. Excessive intensity of the lens lights causes light spillage, interference with pilot's vision, reflection of light into the background, and afterglow. Some of the problems associated with lens intensities are:

- Reflection of light into the background hampers proper identification of the meatball by the pilot on approach and may cause mistaken identification of light reflection for a nonexistent meatball.
- Afterglow may impede the pilot's vision in the final stages of approach, prevent him or her from recognizing a waveoff, and cause the loss of the glide path.

Light brightness settings must always be maintained near the minimum required intensity to compensate for ambient light and weather conditions.

The position of the lens with respect to the sun is a major factor in determining lens intensity settings. Therefore, during conditions such as fluctuating sky coverage, in climate weather, and different times of day (i.e., twilight), the lens intensity may need to be constantly changed.

Continued on next page

Crash equipment

Because of the complexity of FCLP operations, many naval air stations establish special crash crew and equipment requirements.

Station instructions and *Air Operations Manuals* address such issues as crash equipment location and the amount of equipment required for FCLP operations.

Additional FCLP information

Additional FCLP information can be found in *NATOPS Landing Signal Officer Manual,* NAVAIR 00-80T-104

CHAPTER 10

RADAR OPERATIONS

Overview

Introduction

Many of our air stations need to provide continuous service for IFR flight operations. Several facilities have radar rooms manned by Navy air traffic controllers that are capable of providing control for all phases of instrument flight.

This chapter introduces you to the operating positions in a standard Navy radar room and briefly covers the different types of radar services you may provide. Each facility is different. Not everything in this chapter will apply to every Navy air traffic control facility. Letters of Agreement play a role in making operations at a facility unique. You should be familiar with these Letters of Agreement as well as other local directives.

Objectives

The material in this chapter will enable you to:

- State the operating positions and responsibilities associated with each position in a standard Navy air traffic control facility.
- State the methods and procedures to be used when radar is used to identify aircraft.
- Identify the procedures for transferring radar identification.
- Identify what information an approach controller needs to issue to an arriving aircraft.
- Identify when an approach controller needs to issue information to an arriving aircraft.
- State the appropriate actions for assisting aircraft in given emergency situations.
- State the control instructions used by a final controller on A PAR approach.

Continued on next page

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
AC	Arrival controller
AP	Approach controller
ARINC	Aeronautical radio incorporated
ARTCC	Air route traffic control center
ASR	Airport surveillance radar
ATC	Air traffic control
ATCF	Air traffic control facility
ATCS	Air traffic control specialist certificate
ATIS	Automatic terminal information service
CD	Clearance delivery position
CV	Aircraft carrier
DAIR	Direct altitude and identity readout
DC	Departure controller
DF	Direction finder
FAA	Federal Aviation Administration
FC	Final controller
FD	Flight data position
FDIO	Flight data input/output
FSS	Flight service station
FWS	Facility watch supervisor

Continued on next page

Acronyms (continued)

Table continued from page 10-2:

Acronym	Meaning
GCA	Ground controlled approach
IFR	Instrument flight rules
MHz	Megahertz
MSAW	Minimum safe altitude warning
NAVAID	Navigational aid
PALS	Precision approach and landing system
PAR	Precision approach radar
TRSA	Terminal radar service area
VFR	Visual flight rules

Topics

This chapter is divided into five sections:

Section A
Air Traffic Control Facility

Overview

Introduction

The mission of an ATCF is to provide safe, orderly, and expeditious movement of air traffic. This movement takes place within the facility's area of control, to and from operating areas, and into and from the national airspace system.

In this section

This section covers the following topics:

Air Traffic Control Facility

Introduction

In a Navy ATCF, the radar room is normally located in the operations building.

Radar room equipment

The radar room contains remote radar scopes and control consoles for each of the following pieces of radar equipment:

- Surveillance and precision radar display
- Interphone equipment
- Altimeter setting indicators
- Radio receiver and transmitter controls and an emergency communication system
- Weather dissemination and display devices
- Wind direction and speed indicators
- Navigational aid monitor or monitors
- ATC radar beacon interrogator equipment and display
- Video mapper
- Flight progress strip holders/boards
- VISCOM
- FDIO
- ATIS

Radar room services

Services provided in accomplishing this mission include, but are not limited to, the following:

- Providing departure control service to departing aircraft
- Transitioning departing aircraft into the enroute flight structure
- Providing approach control service to arriving aircraft
- Conducting and monitoring aircraft instrument approaches during periods of IFR weather conditions
- Assisting aircraft in emergency situations

Supervisor Positions

Introduction

There are usually two supervisor positions in an air traffic control facility—the radar chief and the radar supervisor.

Radar branch chief

The radar chief assists the ATCF officer in managing radar operations. The radar chief must possess the ATCS certification for the type facility to which he or she is assigned and be designated in writing by the ATCF officer. The chief's duties include the following:

- Overseeing the maintenance of a library of facility directives and other regulations pertaining to radar operations
- Directing the record keeping for radar branch equipment to include records of outages and corrective actions taken to correct discrepancies
- Maintaining operational continuity between various watch teams
- Qualifying personnel on individual operating positions and recommending certification in conformance with *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114, and local directives
- Ensuring the currency of controllers' qualifications
- Evaluating and recommending to the facility officer the operational readiness of branch equipment
- Supervising FAA and military flight inspections
- Providing technical assistance to the ATCF officer in development of procedures

Radar supervisor

The radar supervisor is responsible to the facility watch supervisor (FWS) for operational efficiency of the watch team. The radar supervisor must be qualified on all radar operating positions and possess the ATCS rating or ratings for the type of facility to which he or she is assigned. The duties of the radar supervisor include the following:

- Coordinating and directing control of air traffic within assigned airspace

Continued on next page

Radar supervisor (continued)

- Briefing the radar watch team on weather conditions, traffic, equipment status, and field conditions
- Assigning personnel to operating positions according to individual qualifications and training requirements as directed
- Assigning trainees to qualified controllers for supervision and training
- Notifying SAR agencies of aircraft in distress and providing assistance and advice during emergencies

Section B
Operating Positions

Overview

Introduction

This section describes the functions and responsibilities of ATCFs in providing radar ATC services regardless of equipment installation or configuration. Operating positions may, however, be added, deleted, or combined to meet local requirements.

In this section

This section covers the following topic:

Radar Operating Positions

Introduction

Each facility has its own training program for radar operating positions that is designed to fit the needs of the facility. The radar operating positions covered in this chapter are representative of what you will find at ATCFs that provide approach control services.

Approach controller (AP)

The approach controller coordinates and controls all instrument traffic within the ATC facility area of jurisdiction. Primary duties of the approach controller include the following:

- Issuing ATC clearances and advisory information to aircraft under approach control jurisdiction
- Maintaining radar surveillance of assigned areas and providing radar services to aircraft as required
- Determining the separation and sequence to be used between aircraft
- Initiating and accepting radar handoffs from adjacent sectors and facilities
- Providing priority assistance and services to aircraft in emergency situations

Departure controller (DC)

The departure controller maintains radar surveillance of the assigned area of jurisdiction and provides radar air traffic control services. Duties of the departure controller include the following:

- Issuing clearances and advisory information to aircraft under departure control jurisdiction
- Initiating and accepting radar handoffs to adjacent sectors and facilities

Final controller (FC)

Duties of the final controller include the following:

- Providing instructions for an aircraft to conduct ASR, PAR, and PALS approaches
- Monitoring approaches as specified in *Air Traffic Control,* FAA Order 7110.65

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Radar operating Positions, Continued

Arrival controller (AC)

Duties of the arrival controller include the following:

- Maintaining radar surveillance of the assigned area of jurisdiction and providing radar ATC services
- Issuing clearances and control instructions to aircraft operating under arrival control jurisdiction
- Accepting radar handoffs from approach control
- Providing radar ATC services to aircraft until the aircraft reaches approach minimums or is handed off to a final controller or adjacent facility

Flight data (FD) position

Duties of the controller operating the flight data position include the following:

- Operating communications equipment associated with the FD position
- Receiving and relaying aircraft movement data
- Operating ATIS and FDIO equipment
- Monitoring NAVAID alarm systems
- Preparing and posting flight progress strips

Clearance delivery (CD) position

The controller operating this position relays ATC clearances received from the local ARTCC to aircraft before flight. Normally, this controller uses a discrete radio frequency to deliver the clearance to the aircraft before the aircraft receives taxi instructions.

Section C
General Radar Operating Procedures

Overview

Introduction

Certain radar procedures apply in almost every radar environment. So, when you change duty stations and are assigned to the radar branch of an ATCF, you will already know some basic radar procedures.

In this section

This section covers the following topics:

Radar Identification Procedures

Introduction

Before providing radar service, you must establish the identification of the aircraft involved. The following are the two means you have to do this:

- By the primary or "skin paint" return and associated methods
- By the secondary beacon return and its associated methods

Air Traffic Control, FAA Order 7110.65, contains a complete listing of radar identification methods.

Primary return radar identification

When identifying a primary aircraft target, use one of the following methods:

- At airports with an operating control tower, observe a departing aircraft target within 1 mile of the takeoff runway end provided that each departing aircraft employs one of the following types of rolling notifications:

  –A verbal rolling notification issued by a controller or the pilot
  –A nonverbal rolling notification concerning the aircraft

- Observe an aircraft target whose position with respect to a fix or visual reporting point corresponds with a direct position report received from an aircraft. Note that the observed track of the aircraft target is consistent with the reported heading or route of flight.

- Observe an aircraft target that makes an identifying turn or turns of 30 degrees or more and one of the following conditions exists:

  –The pilot has reported the aircraft's position and the position is within coverage of your radar as well as within your current radar display coverage **and** you observe only one aircraft making the turns, or
  –For aircraft operating in accordance with an IFR clearance, you either issue a heading away from an area which will require an increased minimum IFR altitude or have the aircraft climb to the highest minimum altitude in your area of jurisdiction before you issue a heading.

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Secondary return radar identification

When using secondary beacon returns to identify a target, use one of the following methods:

- Request the pilot to activate the IDENT feature of the aircraft transponder and observe the identification display.
- Request the pilot to change the aircraft's transponder to a specific beacon code. Then observe the target display change.
- Request the pilot to change the aircraft's transponder to STANDBY. Observe the display target disappear for a sufficient time to be assured that the disappearance was caused by activating the standby feature. Then request the pilot return the transponder to NORMAL operation and observe the reappearance of the target.

Where circumstances cause doubt as to target identification, you should use more than one method to establish radar identification.

Position information

Inform the pilot of the aircraft's position whenever radar identification is established by means of either identifying turns or secondary radar beacon procedures. It is not necessary to provide position information to the pilot when radar identification is established by position correlation or when a departing aircraft is identified within 1 mile of the takeoff runway end.

Establishing radar identification

Inform the pilot of *RADAR CONTACT* whenever either of the following conditions exist:

- After initial identification within the ATC system
- After identification is reestablished with an aircraft after either having lost radar contact or radar service having been previously terminated with the aircraft

Inform the pilot when radar contact is lost by transmitting *RADAR CONTACT LOST.*

NOTE: If required, issue alternate instructions when the identity or position of a radar-identified aircraft is in doubt or the target is unusable.

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Terminating radar services

RADAR SERVICE TERMINATED is a term used by ATC to inform a pilot that he or she will no longer be provided any of the services that could be received while under radar contact. Radar service is automatically terminated and the pilot is not advised of termination in the following cases:

- When an aircraft cancels its IFR flight plan, except within Class B or C airspace, TRSA, or where basic radar service is provided
- At the completion of a radar approach
- When an aircraft that is conducting a visual approach or contact approach has landed or has been instructed to change to an advisory frequency
- When an aircraft that is making an instrument approach has landed or has been instructed to change to an advisory frequency

Transfer of Radar Identification Procedures

Introduction

No one controller controls a given flight from takeoff to landing. Several controllers, each responsible for a certain area, control the flight at different times. Therefore, the process of transferring control of the aircraft from one controller to another must be precise and accurate. Radar identification is normally transferred by performing a handoff, by conducting a point out, or by using the term *Traffic. Air Traffic Control,* FAA Order 7110.65, outlines transfer of radar identification procedures.

Handoff

A handoff is action taken to transfer the radar identification of an aircraft from one controller to another controller. This action is required when the aircraft will enter the receiving controller's airspace **and** radio communications with the aircraft will be transferred.

Transferring controller responsibilities during a handoff

The transferring controller must:

- Complete a radar handoff before an aircraft enters the airspace delegated to the receiving controller, and
- Verbally obtain the receiving controller's approval before making any changes to an aircraft's flight path, altitude, or data block information while the handoff is being initiated or after acceptance, unless otherwise specified by a letter of agreement or a facility directive.

Receiving controller responsibilities during a handoff

The receiving controller must:

- Ensure that the target position corresponds with the position given by the transferring controller or that there is an association between an automated data block and the target being transferred before accepting a handoff,
- Issue restrictions that are needed for the aircraft to enter your sector safely before accepting the handoff, and
- Comply with restrictions issued by the initiating controller unless otherwise coordinated.

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Transfer of Radar Identification Procedures, Continued

Point out

A point out is a physical or automated action taken by a controller to transfer the radar identification of an aircraft to another controller when the aircraft will or may enter the airspace or protected airspace of another controller. Radar identification is being made to the other controller, but radio communications will not be transferred.

Transferring controller responsibilities during a point out

The transferring controller must:

- Obtain verbal approval before permitting an aircraft to enter the receiving controller's delegated airspace (automated approval may be used in lieu of verbal when an automated point out function exists),
- Obtain the receiving controller's approval before making any changes to an aircraft's flight path, altitude, or data block information after the point out has been approved,
- Comply with restrictions issued by the receiving controller unless otherwise coordinated, and
- Be responsible for subsequent radar handoffs and communications transfer, including flight data revisions and coordination, unless otherwise agreed to by the receiving controller or as specified in a letter of agreement.

Receiving controllers responsibilities during a point out

The receiving controller must:

- Ensure that the target position corresponds with the position given by the transferring controller or that there is an association between a computer data block and the target being transferred before approving a point out,
- Be responsible for separation between point out aircraft and other aircraft for which he or she has separation responsibility, and
- Issue restrictions necessary to provide separation from other aircraft within his or her area of jurisdiction.

Additional responsibilities

Additional transferring and receiving controller responsibilities during a handoff or point out can be found in *Air Traffic Control,* FAA Order 7110.65.

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Traffic

Traffic is a term used to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued in each of the following situations:

- In response to a handoff or point out
- In anticipation of a handoff or point out
- In conjunction with a request for control of an aircraft

Methods for transferring radar identification

Transfer the radar identification of the aircraft by using one of the following methods:

- Physically point to the target on the receiving controller's display
- Use landline voice communications
- Use automation capabilities

Information relayed to the receiving controller

Inform the receiving controller of the following information:

- The position of the target relative to a fix, map symbol, or radar target known and displayed by both the receiving and transferring controller
- The aircraft identification (aircraft callsign or discrete beacon code)
- The assigned altitude, appropriate restrictions, and information that the aircraft is climbing or descending

Procedures after aircraft identification transfer

After you identify the target being transferred, inform the transferring controller of radar contact by transmitting *BRAVO HOTEL ONE ONE, RADAR CONTACT.* If needed, issue frequency and beacon code change information. *Air Traffic Control,* FAA Order 7110.65, has a complete section on procedures used for the transfer of radar identification and its associated coordination.

Transfer of communication

Transfer radio communications before an aircraft enters the receiving controller’s area of jurisdiction unless otherwise coordinated or specified by a letter of agreement or a facility directive.

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Control transfer

Transfer control of an aircraft as follows:

- At a prescribed or coordinated location, time, fix, or altitude; or
- (When authorized by a facility directive or letter of agreement) at the time of a radar handoff and frequency change to the receiving controller.

Transfer control of an aircraft only after eliminating any potential conflict with other aircraft for which you have separation responsibility. Assume control of an aircraft only after it is in your area of jurisdiction unless specifically coordinated or as specified by letter of agreement or facility directive.

Identity confirmation

After you accept a handoff from another facility or controller, confirm the identity of a primary target by advising the aircraft of its position. Conversely, if it is a beacon-equipped aircraft, you should observe an IDENT, a beacon code change, or a standby action. If any of these were accomplished during the handoff, they need not be repeated. These confirmation procedures do not apply at a tower or GCA that provides radar separation for an area specified by its parent approach control facility. In such situations, sequencing or positioning before the handoff assures aircraft identification.

Arrival Information

Introduction

Airfield status and weather information is critical to the aircraft recovery process. As a radar controller, you relay this information to arriving aircraft.

Landing information

After you establish radio contact with an arriving aircraft and the pilot requests a radar approach, provide the pilot with the following information:

- Altimeter setting.
- Ceiling and visibility if the ceiling and visibility at the airport of intended landing is reported below 1,000 feet or below the highest circling minimum whichever is greater. Also, if the visibility is less than 3 miles.
- Special weather observations.
- Airport conditions that may affect flight safety.
- Lost communications procedures when required.

IFR weather conditions

When weather reports indicate that an aircraft will likely encounter IFR weather conditions during an approach, you must issue a lost communications procedure. You should:

- Advise the pilot to attempt to contact you on another frequency if radio communications are lost between you and the pilot for a period of time not to exceed the following criterion:

  —*1 minute* while being vectored to the final approach course and
  —*15 seconds* on a surveillance final approach or 5 *seconds* on a PAR final approach.

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IFR weather conditions (continued)

- Tell the pilot the frequency and advise him or her to proceed VFR if able. If the pilot is not able to proceed VFR, tell the pilot to proceed with a specific nonradar approach, or give specific alternate instructions for the pilot to follow such as holding instructions.

This action should be taken after you establish radar identification and radio communications. You may omit this information after the first approach when successive approaches are made and the instructions remain the same.

Pilot responsibilities

The pilot determines the adequacy of the lost communications procedures you issue. When the pilot states that the procedures provided cannot be accepted, request that he or she advise you of what will be done if communications are lost. Make sure that you get the entire procedure the pilot will follow and not half the facts. After you have lost radio contact, it's too late to get any more information.

Section D
Specific Radar Procedures

Overview

Introduction

The radar procedures discussed in this section pertain to the ATC program ashore. Detailed procedures for shipboard operations are contained in the *CV NATOPS Manual,* NAVAIR 00-80T-105, and the *LHA/LPH/LHD NATOPS Manual,* NAVAIR 00-80T-106. The basic control procedures apply to all areas of radar air traffic control.

In this section

This section covers the following topic:

Radar Sequencing and Separation

Introduction

As with airport control tower operations, the FAA specifies sequencing and separation criteria that you must use as a radar controller. Also, local air operation and facility manuals may require certain airfield unique procedures.

Sequencing and separation criteria

Air Traffic Control, FAA Order 7110.65, (chapters 4, 5, and 6) outlines a majority of the sequencing and separation procedures you will use as a radar controller.

Objectives

The material in *Air Traffic Control,* FAA Order 7110.65, (chapters 4, 5, and 6) will enable you to:

- Apply radar vectoring methods to typical situations.
- Describe the procedures for issuing holding instructions.
- Identify minimum radar separation standards.
- State the control actions that should be taken at given times in PAR and ASR approaches and the procedures used in circling and visual approaches.
- State procedures for handling radar departures.

PAR Approaches

Introduction

In the precision approach, precise control instructions are issued to the pilot so that he or she may align the aircraft on the glide path and course line.

Procedures

Air Traffic Control, FAA Order 7110.65, outlines the procedures and phraseology you will use to conduct a PAR (as well as a surveillance) approach.

Glide path

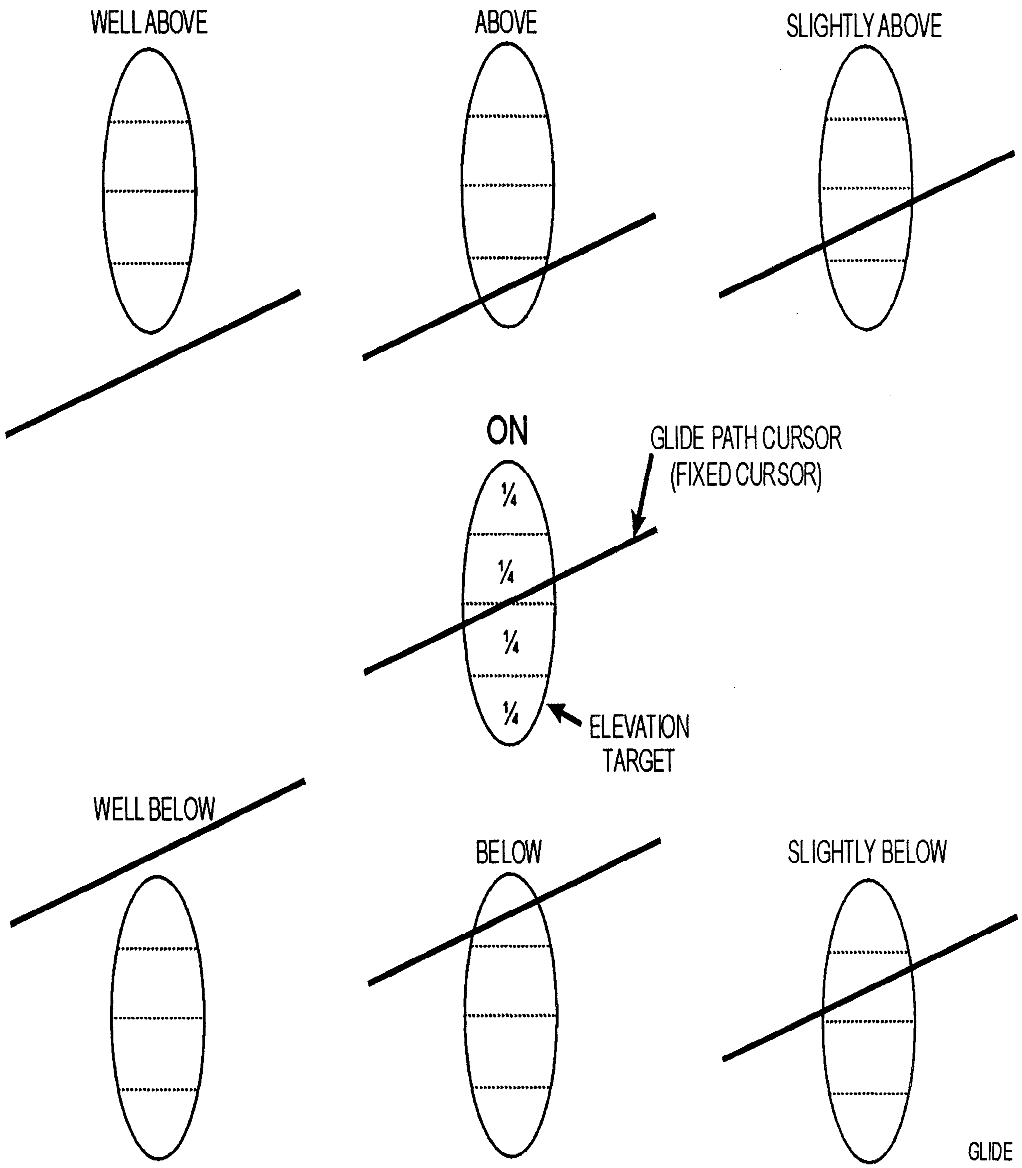
The radar final controller must issue precise elevation information for the pilot to establish and maintain a proper rate of descent. The controller mentally divides the elevation target into quarters to advise the pilot of any deviation from glide path. The following table describes the relationship between the glide path information relayed to the pilot based on the corresponding aircraft target position on the PAR elevation cursor:

Glide path information	Determined By (Aircraft Target Position)
On glide path	The glide path cursor bisects the elevation target
Slightly above glide path	The glide path cursor intersects the elevation target through its lower middle quarter
Slightly below glide path	The glide path cursor intersects the elevation target through its upper middle quarter
Above glide path	The glide path cursor intersects the elevation target through its lower-most quarter
Below glide path	The glide path cursor intersects the elevation target through its upper-most quarter
Well above glide path	The glide path cursor is below (doesn't touch) the elevation target
Well below glide path	The glide path cursor is above (doesn't touch) the elevation target

Continued on next page

Glide path (continued)

The following figure depicts the aircraft's target position in relation to the glide path cursor:



Section E
Emergency Assistance

Overview

Introduction

A primary duty of any ATC operating position is to provide priority assistance and services to aircraft in emergency situations. This section focuses on those types of emergencies that might normally be encountered by radar controllers. However, since potential emergencies defy standardization, the best advice we can present on emergencies is to expect the unexpected!

In this section

This section covers the following topics:

Requirements

Introduction

Start assistance to an emergency aircraft when enough information has been obtained upon which to act.

Requirements

Information requirements vary depending on the existing situation. The minimum required information for in-flight emergencies is as follows:

Minimum Required Information	After Initiating Action, Obtain as Necessary
• Aircraft identification and type • Nature of the emergency • Pilot's desires	• Aircraft altitude • Fuel remaining in time • Pilot reported weather • Pilot capability for IFR flight • Time and place of last known position • Heading since last known position • Airspeed • Navigation equipment capability • NAVAID signals received • Visible landmarks • Aircraft color • Number of people on board • Point of departure and destination • Emergency equipment on board

Guiding inexperienced pilots

Inexperienced pilots often need help when they encounter IFR weather. The major concern is to locate and identify the aircraft and then orient the pilot who has lost his or her bearing. One or more of the following recognized methods should be used:

Continued on next page

Guiding inexperienced pilots (continued)

- Radar
- Following another aircraft
- NAVAIDs
- Pilotage by landmarks
- Compass headings

Emergency frequencies

Although the frequency in use or other frequencies assigned by ATC are preferable, the emergency frequencies can be used for distress and urgency communications, if necessary or desirable.

121.5 MHz and 243.0 MHz (note that 121.5 is one-half of 243.0) have a range generally limited to line of sight. 121.5 MHz is guarded (monitored) by DF stations and some military and civil aircraft. 243.0 MHz is guarded by military aircraft. Both 121.5 MHz and 243.0 MHz are guarded by military towers, most civil towers, FSSs, and radar facilities. Normally, ARTCC emergency frequency capability does not extend to radar coverage limits.

Radar Assistance to VFR Aircraft in Weather Difficulty

Introduction

The type of radar assistance that can be provided to a VFR aircraft in weather difficulty depends upon whether the pilot is IFR qualified or not and whether he or she desires to file an IFR flight plan.

Initial steps

If a VFR aircraft requests radar assistance when it encounters or is about to encounter IFR weather conditions, first ask if the pilot is qualified for and capable of conducting IFR flight. If the pilot is qualified and capable, then request an IFR flight plan be filed. Issue and coordinate the appropriate clearance.

Assistance without an IFR flight plan

If the pilot is not qualified, or refuses to file an IFR flight plan, then take the following action(s):

1. Inform the pilot of airports where VFR conditions are reported; then ask the pilot to conduct a VFR flight to such an airport.
2. When the action in item (1) can't be done or if the pilot declines to conduct VFR flight, provide radar assistance if the pilot

   - declares an emergency or
   - refuses to declare an emergency and you have determined the exact nature of the radar services the pilot desires.

3. If the aircraft has already encountered IFR conditions, inform the pilot of the appropriate terrain/obstacle clearance minimum altitude. If the aircraft is below the appropriate terrain/obstacle clearance minimum altitude and you receive sufficiently accurate position information or have established radar identification, furnish the pilot a heading or radial on which he or she can climb to reach the minimum safe altitude.

Continued on next page

Assistance techniques for the non-IFR qualified

If possible, use the following techniques when you provide radar assistance to a pilot not qualified to fly in IFR conditions:

- Avoid radio frequency changes except as needed to provide a clear communications channel.
- Require the pilot to make turns while the aircraft is in VFR conditions so that the aircraft will be in straight and level flight while in IFR conditions.
- Have the pilot lower the aircraft's landing gear and slow the aircraft to approach speed while in VFR conditions.
- Avoid requiring the pilot to climb or descend while in a turn in IFR conditions.
- Avoid requiring any abrupt maneuvers.
- Vector the aircraft to VFR conditions.
- Assign a beacon code that will permit MSAW alarm processing, provided the aircraft is radar beacon-equipped and radar beacon code 7700 is no longer required.

Hijacked Aircraft

Introduction

Aircraft hijacking is a special emergency that constitutes a condition of air piracy, or other hostile act by a person(s) aboard an aircraft, that threatens the safety of the aircraft or its passengers.

Notification

Military facilities are required to notify the appropriate FAA ARTCC (or the host nation agency responsible for enroute control) of any indication that an aircraft is being hijacked. Also, they are required to provide full cooperation in the control of such an aircraft.

Aircraft hijacking in progress code

A pilot should transmit radar beacon code 7500 when his or her aircraft is being unlawfully interfered with.

Controller response to code 7500

When you observe a radar beacon code of 7500 on your radar scope, you should take the following actions:

1. Acknowledge and confirm receipt of the code by asking the pilot to verify it.

EXAMPLE

(Aircraft call sign) (name of facility) VERIFY SQUAWKING SEVEN FIVE ZERO ZERO.

If the aircraft is not being unlawfully interfered with, the pilot should inform you of such. When no reply is received or a reply is to the affirmative, make no other requests, but be responsive to requests from the aircraft.

2. Notify supervisory personnel.

3. Follow the aircraft's flight and make normal handoffs without requiring transmissions or responses by the pilot unless communications have been established. If communications are established, follow routine procedures.

Continued on next page

Controller response to code 7500 (continued)

4. If escort aircraft are dispatched, provide all possible assistance to the escort aircraft in placing them in a position *behind* the hijacked aircraft.

When possible, give these same control services to VFR aircraft observed displaying the hijack code.

Radio Communications Failure

Introduction

Another type of emergency that frequently occurs is two-way radio failure. Two-way radio communication is of primary importance in the control of IFR traffic.

Communication failure

Loss of two-way radio communication with an aircraft complicates the job of controlling traffic. When you and the pilot of the aircraft know the emergency procedures for two-way radio failure, there is little danger when this situation occurs. Pilot procedures and recommended practices can be found in *FAR,* Part 91, *AIM,* and NIMA *Flight Information Handbook.*

Clearance in the blind

Remember that the loss of two-way radio communication does not necessarily mean that the aircraft's receivers are not working. Quite often during two-way radio failure, the aircraft's receivers are operating normally and the pilot can receive instructions. With this in mind, you can sometimes issue an appropriate clearance *in the blind.* That is to say, you have no way of knowing whether the pilot receives your clearance or not.

Authorization for clearance in the blind

You must ensure that the aircraft is provided adequate separation from other traffic according to both the original clearance, issued to the pilot before loss of communication, and the latter clearance, which was issued *in the blind.* The agency having control jurisdiction over the aircraft at the time communication is lost will normally be the agency that authorizes or makes such a transmission.

Clearances broadcast in the blind are made through all available means of communication. These may include emergency frequencies, the voice features of NAVAIDs, FSS, and ARINC.

Continued on next page

Use of radar

If your facility is radar equipped, attempt to reestablish communications by having the aircraft use its transponder or make turns to acknowledge clearances or to answer specific questions. By observing transponder and target returns on your radar indicator, you can determine if the aircraft is receiving your instructions.

Sometimes, the pilot attempts to advise radar facilities of the type of radio difficulty that he or she is experiencing. Should the pilot of an aircraft equipped with a coded radar-beacon transponder experience a loss of two-way radio capability, he or she should adjust the aircraft's transponder to reply on mode 3/A code 7600.

In attempting to reestablish communication with an aircraft when your facility is radar equipped, the phraseology that you should use is as follows: REPLY NOT RECEIVED, (appropriate instructions). If the pilot then follows your instructions, use the following phraseology: (action) OBSERVED, (additional instructions/information if necessary).

Vectoring intercept aircraft

Should the aircraft have both transmitter and receiver failure, you may be able to vector an intercept aircraft to rendezvous with the aircraft experiencing the emergency. The intercepting aircraft can then lead (escort) the aircraft with the emergency to a suitable airport for landing.

CHAPTER 11

SHIPBOARD OPERATIONS

OVERVIEW

Introduction

Shipboard operations is one of the most exciting, fast-paced environments in the air traffic control field. Your ability to make a quick, accurate separation decision is vital to aircraft safety at sea. After completing this chapter, you should have an understanding of the complex world of carrier and amphibious air traffic control operations.

Objectives

The material in this chapter will enable you to:

- Identify the responsibilities and general operating procedures of the CATCC during carrier operations.
- Identify the duties of the departure controller.
- Identify the procedures used by arrival controllers.
- Describe tanker operations during a recovery.
- Identify the general operating procedures of the AOCC/HDC during LHA/LHD operations

Acronyms

The following table contains a list of abbreviations and acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
Air Ops	Air operations
AFCS	Automatic flight control system
AOA/AOR	Amphibious objective area/area of responsibility
AOCC	Air operations control center
APC	Approach power compensator

Continued on next page

Acronyms (continued)

Table continued from page 11-1.

Acronym	Meaning
ASR	Airport surveillance radar
ATCF	Air traffic control facility
BRC	Base recovery course
CAS	Close air support
CATCC	Carrier air traffic control center
CATF	Amphibious task force commander
CCA	Carrier controlled approach
CDC	Combat direction center
CLF	Landing force commander
CP	Control point
COD	Carrier on board delivery
DAIR	Direct altitude and identification readout
DME	Distance measuring equipment
DRR	Departure reference radial
EAT	Expected approach time
EEAT	Emergency expected approach time
EFB	Emergency final bearing
FB	Final bearing

Continued on next page

Acronyms (continued)

Table continued from page 11-2.

Acronym	Meaning
FDC	Flight deck control
FLOLS	Fresnel lens optical landing system
HDC	Helicopter direction center
IAF	Initial approach fix
ICLS	Instrument carrier landing system
IFF	Identification friend or foe
ILM	Independent landing monitor
IMC	Instrument meteorological conditions
KIAS	Knots indicated airspeed
LHA/LHD	Amphibious assault aviation ship
LSE	Landing signal enlisted
LSO	Landing signal officer
MOVLAS	Manually operated visual landing system
nm	Nautical mile
OTC	Officer in tactical command
PALS	Precision approach and landing system
PriFly	Primary flight control
SAR	Search and rescue
TACC	Tactical air control center
TACRON	Tactical air control squadron

Continued on next page

Acronyms (continued)

Table continued from page 11-3.

Acronym	Meaning
UTM	Universal test message
VDB	Visual display board
VFR	Visual flight rules
VMC	Visual meteorological conditions
V/STOL	Vertical/short takeoff and landing

Continued on next page

Overview, Continued

Topics

This chapter is divided into 10 sections:

Section A
Definitions

Overview

Introduction

Before jumping into the concepts that make up shipboard air traffic control, you must become familiar with the definitions and terminology used on a daily basis on an aircraft carrier, LHA, or LHD.

In this section

This section covers the following topic:

Definitions

Introduction

Personnel assigned to an aircraft carrier, LHA, or LHD encounter a different air traffic language. For air operations to function properly, these new terms must be understood.

Terms and definitions

The following table contains definitions that pertain to shipboard operations:

Term	Definition
Advisory control	A form of air traffic control in which the controlling agency monitors radar and radio contact with the aircraft under its control and provides traffic advisories. The individual pilot is responsible for traffic separation with the assistance from the control agency.
Air operations	The section of the operations department that coordinates all matters pertaining to air operations including the proper functioning of the CATCC or AOCC/HDC.
Air operations control center/helicopter direction center (AOCC/HDC)	A centralized air control agency that maintains status and tactical control of all aircraft not assigned to TACC. Also responsible for IMC approach and departure control. Becomes the HDC for tactical control of helicopters during amphibious operations.
Amphibious assault aviation ship	An LHA and LHD.
Amphibious task force commander (CATF)	The officer designated in the initiating directive as commander of an amphibious task force.
Angels	Altitude in thousands of feet.
Approach control	A control position in CATCC or AOCC/HDC responsible for providing positive control of aircraft on approach during Case II and III. Also, makes holes for bolter/waveoff traffic and maintain appropriate interval. CATCC has two approach control positions, Approach A and Approach B.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-2.

Term	Definition
Ball	A pilot report indicating that the visual landing aid is in sight.
Base recovery course (BRC)	The ship's magnetic heading during flight operations.
Bingo	An order to proceed to and land at the field specified by the use of a bingo profile. The aircraft is in an emergency or fuel critical situation.
Bullseye	A term referring to the ILM.
Buster	An order given to an aircraft to proceed at maximum speed.
Carrier air traffic control center (CATCC)	The centralized agency responsible for the status-keeping of all carrier air operations and the control of all airborne aircraft under the operations officer's cognizance except those being controlled by CDC and the air officer. Comprised of two interdependent work centers, Air Ops and CCA.
Carrier or amphibious control area	A circular airspace within a radius of 50 miles around the ship that extends upward from the surface to unlimited altitude; it is under the cognizance of CATCC or AOCC/HDC except for those aircraft operating under control of the air officer during Case I and II operations.
Carrier or amphibious control zone	The airspace within a circular limit defined by a 5-mile horizontal radius from the ship extending upward from the surface to and including 2,500 feet unless otherwise designated for special operations; under the responsibility of the air officer during VMC.

Continued on next page

Definitions, Continued

Terms and definitions (continued)

Table continued from Page 11-A-3.

Term	Definition
CATCC/AATCC direct altitude and identification readout (DAIR) system	This system is intended primarily for the display of digitally processed, symbolically displayed IFF data; primary radar is also displayed. The digital processing used in CATCC/AATCC DAIR significantly increases the capabilities available to perform air traffic control functions afloat. These capabilities include the following: • Automated handoffs • Aircraft lists that automatically couple aircraft data with a discrete IFF code • Continuous indication of ship's position • Controller-positioned symbols that identify bingo fields, marshal points, or other geographic locations, either geographically fixed or relative to own ship position
Center	A collective radio call prefixed by a ship's code name that is used in the same manner as the shore-based counterpart.
CHARLIE	Signal for aircraft to land aboard the ship. A number suffix indicates time delay before landing.
Cherubs	Altitude in hundreds of feet (applies only to helicopters).
Clara	A pilot transmission meaning he or she does not have the visual landing aid (ball) in sight.
DELTA	A signal given to hold and conserve fuel at an altitude and position appropriate to the type of aircraft and case recovery in effect.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-4.

Term	Definition
Departure control	A control position in CATCC or AOCC/HDC that is responsible for the orderly flow of departing traffic. Also responsible for monitoring the location and package status of tanker aircraft and the location of low-state aircraft and their fuel requirements.
Divert	An order for an aircraft to proceed to and land at the field specified. This is a nonemergency situation.
Emergency expected approach time (EEAT)	The future time, assigned before launch, at which an aircraft is cleared to depart inbound or penetrate from a preassigned fix under lost communication conditions.
Emergency final bearing (EFB)	A magnetic heading provided by AOCC/HDC to each flight crew before launch for the crew to use when executing emergency procedures for communications failure in IMC. The emergency marshal pattern must be relative to the EFB and is the final bearing for the lost communications TACAN approach.
Emergency marshal (carrier)	A marshal established by CATCC and given to each pilot before launch with an altitude and an EEAT. The emergency marshal radial must have a minimum of 30° separation from the primary marshal.
Expected approach time (EAT)	The future time at which an aircraft is cleared to depart inbound from a prearranged fix. Aircraft must depart and begin the approach at this assigned time unless further instructions are received.
Feet dry	A pilot report that indicates his or her aircraft is passing over the shoreline and proceeding over land.
Feet wet	A pilot report that indicates his or her aircraft is passing over the shoreline and proceeding over water.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-5.

Term	Definition
Final bearing (FB)	The magnetic bearing assigned by CATCC or AOCC/HDC for final approach. An extension of the landing area centerline.
Final control	A control position in CATCC or AOCC/HDC that controls aircraft on final approach during Case III until transfer of control to the LSO or the aircraft reaches approach weather minimums. It also entails when aircraft reach VMC on amphibious ships.
Flight level	Pressure altitude expressed in hundreds of feet determined by setting 29.92 in the aircraft pressure altimeter, eg., FL 230 equals 23,000 feet pressure altitude.
FOX CORPEN	Ship's true heading during flight operations.
Instrument carrier landing system (ICLS) approach	A precision approach in which precise and continuous position error and range information from the ILM and TACAN is displayed in an aircraft that enables a pilot to effect a manually controlled precision approach to minimums.
Inbound bearing	The magnetic heading assigned to pilots who descend directly to the carrier. It may be, but is not necessarily, the final bearing. For amphibious operations, it's the magnetic bearing that will ensure interception of the final bearing at a specific distance from the ship.
Inbound heading	The magnetic heading assigned to an aircraft that ensures interception of the final bearing at a specific distance from the carrier.
Independent landing monitor (ILM)	Provides glide slope and azimuth information with ARA-63/SPN-41. Components are the AN/SPN-41 (shipboard) or AN/TRN-28 (shore), and the AN/ARA-63 or AN/ARN-138 (airborne).
Jetborne flight	Very slow speed flight supported by engine thrust only for V/STOL aircraft.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-6.

Term	Definition
KILO report	A pilot-coded report indicating aircraft mission readiness.
Landing force commander (CLF)	The officer designated in the initiating directive to command the landing force.
Marshal	A bearing, distance, and altitude fix designated by CATCC or AOCC/HDC from which the pilots will orient holding and from which the initial approach will commence.
Marshal control	A control position in CATCC or AOCC/HDC that is responsible for providing control and arrival information to aircraft until handed off to another controlling agency.
Mixed operations	Simultaneous V/STOL and helicopter air operations.
Monitor control	The monitoring of radar and radio channels for emergency transmissions. Monitor control shall be used when aircraft are operating in VMC outside of controlled airspace and the responsibility for separation from other traffic can be safely assumed by the pilot.
Manually operated visual landing system (MOVLAS)	An emergency optical landing aid system used when the primary visual landing aid FLOLS becomes inoperative or stabilization limits are exceeded.
Nonprecision approach	Radar controlled approach or an approach flown by reference to navigation aids in which the glide slope information is not available.
Nonradar control	A form of ATC in which the pilot flies according to a published procedure or as prescribed by the controlling agency. The controlling agency provides traffic separation by the use of frequent pilot position reports and modified separation criteria. This form of control is used in an emergency and when all shipboard air control radar is inoperative or unusable. It is also used when the CCA officer or AOCC/HDC officer deems it necessary.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-7.

Term	Definition
Parrot	Military IFF/transponder.
Pigeons	Magnetic bearing and distance from an aircraft to a specific location.
Platform	A point of 5,000 feet altitude in the approach pattern at which all jet and turboprop aircraft decrease their rate of descent to not more than 2,000 feet-per-minute and continue letdown to the 10-nm DME fix.
Popeye	A pilot's term used to indicate that his or her aircraft has entered IMC.
Port holding pattern	The Case I jet and turboprop aircraft holding pattern is a left-hand, 5-mile pattern tangent to the BRC (or expected BRC) with the ship in the 3 o'clock position of the holding pattern. The altitude is assigned via landing order as established in the ship and airwing doctrine.
Positive control (carrier)	A form of air traffic control in which the controlling agency has radar and radio contact with the aircraft that is being controlled, and published approach or departure procedures are complied with. It also pertains to controllers who give specific headings and altitudes for aircraft to fly. While the pilot provides altitude separation by maintaining assigned altitudes, the air traffic controller is responsible for lateral and time separation. The air traffic controller may direct speed changes.
Precision approach	An approach in which the azimuth, glide slope, and distance information are provided to the pilot.
Precision approach and landing system (PALS)	A system that consists of shipboard and aircraft components for all weather recovery of carrier-based aircraft.
PALS acquisition window	An area in space (normally 3.5 to 5 miles from touchdown point) in which PALS radar acquires an aircraft for final control.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-8.

Term	Definition
Primary flight control (PriFly)	The position on the ship where the air officer or designated representative observes flight deck operations and provides visual control to aircraft that operate in the carrier control zone.
Ramp time (ready deck)	Anticipated time specified by PriFly that the deck will be ready to recover aircraft and the first aircraft of a Case III recovery is expected to be at the ramp.
Six nautical mile DME fix (carrier)	A checkpoint on a CCA that is located on the final bearing 6 miles from the carrier through which all jet and turboprop aircraft will pass in level flight at an altitude of 1,200 feet in landing configuration. Turboprop aircraft may be instructed to pass through the 6-nm DME fix at 1,200 feet and commence transition to the landing configuration.
Spin	A signal given to one or more aircraft that indicates a departure from and reentry into the break. The command "Spin" may be issued by either the air officer or the flight leader.
Starboard holding pattern (carrier)	A right-hand racetrack pattern between 045° and 135° relative to the ship for COD aircraft and 045° and 110° relative for helicopters. COD aircraft hold at 500 feet or 1,000 feet if approved by PriFly, and helicopters hold at 300 feet or below.
Tactical air control center (TACC)	The primary air control agency within the amphibious objective area of responsibility from which all air operations that support the amphibious force are controlled. This control refers to all airborne operations not a part of the actual launch or recovery of aircraft.
Tactical direction	A form of nonradar control where tactical information is passed to an aircraft by the controlling unit, but the aircraft commander is responsible for navigation and safety.

Continued on next page

Terms and defiitions (continued)

Table continued from page 11-A-9.

Term	Definition
Ten nautical mile DME fix (carrier)	A checkpoint on a CCA that is normally located on the final bearing 10 miles from the carrier. All jet and turboprop aircraft will pass through the 10-nm DME fix in level flight at an altitude of 1,200 feet at 250 KIAS and will normally commence transition to the landing configuration.
Three nautical mile DME fix	A checkpoint on a CCA that is located on the final bearing 3 miles from the ship through which all turboprops and helicopters will pass in a landing configuration.
V/STOL	An aircraft, other than a helicopter, whose flight characteristics enable vertical and short takeoffs and landings.
Twelve nautical mile DME fix (amphibious)	A checkpoint on a CCA that is normally located on the final bearing 12 miles from the ship. All V/STOL aircraft will pass through the 12-nm DME fix in level flight at an altitude of 1,200 feet at 250 KIAS and will normally commence transition to the landing configuration.

Continued on next page

Definitions, Continued

Terms and definitions (continued)

Table continued from page 11-A-10.

Term	Definition
Weather criteria (amphibious)	The following weather criteria applies to V/STOL aircraft: • Case I—Ceiling no lower than 3,000 feet and visibility not less than 5 nm. • Case II—Ceiling no lower than 1,000 feet and visibility not less than 5 nm. These minimums can be lowered by the ship's commanding officer for special operations. • Case III—Ceiling below 1,000 feet or visibility less than 5 nm. Case III is also used when the ceiling or visibility decreases to below those minimums established by the ship's commanding officer for special operations. The following weather criteria applies to helicopters: • Case I—Ceiling no lower than 1,000 feet and visibility not less than 3 nm. • Case II—Ceiling no lower than 500 feet and visibility not less than 1 nm. • Case III—Ceiling less than 500 feet or visibility less than 1 nm.

Continued on next page

Terms and definitions (continued)

Table continued from page 11-A-11.

Term	Definition
Weather criteria (carrier)	The following weather criteria applies to carrier operations: • Case I—Ceiling no lower than 3,000 feet and visibility not less than 5 miles. • Case II—Ceiling no lower than 1,000 feet and visibility not less than 5 miles. • Case III—Ceiling below 1,000 feet or visibility less than 5 miles. Refer to *CV NATOPS Manual,* NAVAIR 00-80T-105, for helicopter weather criteria during carrier operations.
ZIP LIP	A condition that may be prescribed for flight operations during daylight VMC under which positive communications control is waived. Radio transmissions between aircraft and between pilots and control agencies are held to the minimum necessary for flight safety. For carriers—COD aircraft are exempted from ZIP LIP unless specifically noted in Overhead Message. For amphibious operations—ZIP LIP may be prescribed during night VMC.

Section B
CATCC Operating Positions

Overview

Introduction

The Air Operations Officer is responsible to the Operations Officer for the coordination of all matters pertaining to flight operations and for the proper functioning of CATCC. CATCC is broken down into two branches—Air Ops and CCA. Each of these branches is responsible for certain tasks which are performed by personnel assigned to operating positions within the respective branches. When you are assigned to a carrier, you will have an opportunity to qualify on some, if not all, of the operating positions in CATCC. Remember, no one position is more important than the other; each position is vital to the overall CATCC team and its mission.

In this section

This section consists of the following topics:

Air Ops Operating Positions

Introduction

The Air Ops branch of CATCC, sometimes referred to as the *front room,* performs many of the tasks required to ensure accurate and timely information concerning aircraft operations is disseminated throughout the ship. When you are assigned to Air Ops, you will be required to operate and qualify on different positions that gather and update critical flight operations data.

Operating positions

The following table lists the Air Ops positions and some of their major duties:

Position	Duties
Air operations officer	• Review air plan • Supervise and coordinate the execution of the air plan • Ensure all operational information required for aircraft operations is forwarded to the appropriate personnel • Conduct air wing and squadron briefings • Ensure that records and reports of flight operations are prepared and maintained • Receive, respond to, and prepare all correspondence related to flight operations
Air operations watch officer	• Ensure prelaunch briefing information is timely and efficiently distributed • Provide pertinent flight operations information and air plan changes to appropriate departments and personnel • Manage fuel assets, monitor tanking station assignments, and tanking procedures • Remain informed of the status of helicopters operating with the carrier • Assist CDC and PriFly with SAR operations

Continued on next page

Operating positions (continued)

Table continued from page 11-B-2.

Position	Duties
Air Ops supervisor	• Ensure assigned personnel are properly trained and qualified • Ensure all status board information is accurate and complete • Ensure CATCC equipment and systems are being operated per EMCON restrictions • Ensure master air plan is maintained and that changes and revisions are forwarded to the proper personnel • Ensure prelaunch information is accurate and complete • Ensure weather information for the ship and bingo fields is updated • Ensure all alert condition information is posted and updated as necessary • Ensure that the land/launch record is accurate and complete • At the completion of flight operations, ensure all reports are completed (e.g., master air plan, land/launch record, daily air operations summary, etc.)
Air Ops plotter	• Plot ship's position • Determine the range and bearing to divert and bingo fields and update appropriate status boards

Continued on next page

Operating positions (continued)

Table continued from page 11-B-3.

Position	Duties
Air Ops plotter (continued)	• Depict the ship's position in relation to airways, hot areas, airspace boundaries, etc. on appropriate charts • Place bingo fields and ship's current weather on status boards • Prepare and disseminate prelaunch briefing information
Land/Launch recorder	• During flight operations, maintain the land/launch record by updating and revising such information as: –event numbers –aircraft side numbers –pilot names –launch times –recovery times –aircraft mission –aircraft profiles
Status board keeper	• Maintain status boards with current event numbers, side numbers, and pilot names • During Case III operations, update aircraft lineup information • Record and update aircraft profiles (e.g., bolters, traps, waveoffs, etc.) • Record aircraft launch and recovery times • Record and update aircraft fuel states • When needed, coordinate information between PriFly, CDC, FDC, ready rooms, and CCA

Continued on next page

CCA Operating Positions

Introduction

The controllers in CCA, sometimes referred to as the *back room,* update and change aircraft data on status boards similar to the controllers in Air Ops; however, they also provide sequencing and separation to aircraft during launches and recoveries.

As a CCA controller, you will be required to perform and qualify on control positions such as approach control, marshal control, and departure control and noncontrol positions such as approach status board keeper and VDB operator.

Operating positions

The following table lists the CCA positions and some of their major duties:

Position	Duties
CCA officer	• Prior to flight operations, identify any possible problems that may affect the launch and recovery of aircraft • Determine the instrument approach procedure and marshal radial for Case II and III recoveries • Brief CCA personnel on all relevant information (e.g., BRC, ramp time, airspace constraints, etc.) concerning launch and recovery operations • Ensure all aircraft conform to departure and recovery procedures and that sufficient separation is provided during Case II and III operations • Monitor aircraft and tanker fuel states • Coordinate refueling operations with Air Ops and departure control • Make decisions concerning issuing a *DELTA* • Conduct air wing and squadron debriefings

Continued on next page

Operating positions (continued)

Table continued from page 11-B-5.

Position	Duties
CATCC supervisor	• Assist the CCA officer in his or her duties • Assign CCA personnel to flight operations positions • Identify airspace constraints that may affect launch and recovery operations • Brief and debrief the CCA team on flight operations • Ensure that CCA status boards are accurate and complete • Ensure that CATCC equipment is functioning properly and report discrepancies • Supervise CCA personnel and provide coordination between the CCA team as needed • Monitor aircraft fuel states and tanker operations • Coordinate actions to deal with aircraft emergencies, low fuel states, and other aircraft problems with the CCA officer
Approach control	• Maintain adequate separation and ensure safety of flight • Identify any airspace constraints that may affect recovery operations • Ensure approach status board is accurate and complete • Coordinate with the CATCC supervisor for recovery information such as type recovery, expected BRC, marshal radial, expected final bearing, etc. • Provide positive control instructions to recovery and (during Case III) bolter aircraft • Coordinate handoffs with the CATCC supervisor, marshal control, departure control, final control, the other approach control • Continue to monitor aircraft after handoff to the final controller to ensure sufficient separation is maintained **NOTE:** Two approach control positions are normally manned during Case III operations

Continued on next page

Operating positions (continued)

Table continued from page 11-B-6.

Position	Duties
Marshal control	• Provide marshal instructions including EATs to recovering aircraft • Maintain adequate separation between aircraft • Identify airspace constraints that may affect recovery operations • Coordinate with the CATCC supervisor for recovery information such as type recovery, expected BRC, marshal radial, etc. • Ensure marshal status board is accurate and updated as necessary • Coordinate handoffs with the CATCC supervisor, approach control, departure control, and any other appropriate agencies • Issue speed adjustments and radar vectors to aircraft when necessary • Monitor fuel states of aircraft inbound to and established in marshal • Implement *DELTA* procedures when directed
Final control	• Maintain adequate separation and ensure safety of flight • Coordinate with the CATCC supervisor for recovery information such as type recovery, expected final bearing, bolter holes, etc. • Coordinate handoffs with the CATCC supervisor, approach control, and the other final controller • Provide aircraft with precision and nonprecision approaches **NOTE:** Two final control positions are normally manned during Case III operations

Continued on next page

Operating positions (continued)

Table continued from page 11-B-7.

Position	Duties
Departure control	• Maintain adequate separation and ensure safety of flight • Review the tanking plan • Coordinate with CATCC supervisor for type departure, BRC, and DRR • Prior to launch, provide departing aircraft with any changes in departure information such as mission, type departure, DRR, BRC, etc. • If weather conditions warrant, provide positive control to launching aircraft • Monitor performance of departing aircraft until pilots report KILO or aircraft are handed off to another agency • Coordinate handoffs with CATCC supervisor, approach control, CDC, and marshal control • Monitor tanker position, tanker refueling status, tanker fuel state and give, receiver aircraft position, and all other matters evolving around tanker operations • Maintain a count of aircraft launched and remaining to be launch • During Case III operations, conduct a communications check with the plane guard helicopter at least every 20 minutes • Provide relevant launch and recovery information to the plane guard helicopter
Marshal status board keeper	• Prior to the commencement of recovery operations, record pre-recovery information such as event number, type of recovery, expected final bearing, ramp time, aircraft side numbers, etc. • Monitor the marshal frequency and obtain and record pertinent marshal information (e.g., EAT, fuel state, emergency information, approach button, etc.)

Continued on next page

Operating positions continued)

Table continued from page 11-B-8.

Position	Duties
Approach status board keeper	• Prior to the commencement of recovery operations, record pre-recovery information such as type of recovery, expected final bearing, BRC, ramp time, aircraft side numbers, etc. • Monitor approach/final frequencies and record any changes such as aircraft profiles, fuel states, approach status, etc.
Departure status board keeper	• Prior to the commencement of launch operations, record prelaunch information such as event number, type of launch, expected DRR, BRC, ship's weather, aircraft side numbers, etc. • Monitor departure frequency and record departure information such as launch times, aircraft profiles, tanker status, fuel states, planeguard communication checks, etc. • Coordinate with the departure controller to maintain an accurate and complete account of launch operations
Sound-powered phone talker/VDB operator	• Monitor approach and final control to obtain aircraft recovery order • Maintain an accurate account of aircraft recovery order and position on the VDB • Provide LSO and PriFly with aircraft recovery order and approach/final button (frequency) • Obtain Mode I wire engagement information

Section C
CATCC Control Criteria

Overview

Introduction

On a carrier, the time it takes to launch and recover aircraft is critical to mission readiness. These operations must be completed quickly and safely to deter any potential threat. Therefore, different types of control procedures and reduced separation standards are applied during shipboard operations. As a controller at sea, you must be thoroughly familiar with these control procedures and reduced separation standards and be able to apply them during aircraft launches and recoveries.

In this section

This section consists of the following topics:

Control Procedures

Introduction

In a carrier control zone, weather is the most prominent factor affecting the type of departure and/or recovery. The three types of departure and recovery operations are Case I, II, or III. After the Air Officer determines the case launch and/or recovery, you, in conjunction with the officers and supervisors in CATCC, must determine which type of approach and degree of control will be used for each launch and recovery cycle. The four degrees of control are positive, advisory, monitor, and nonradar.

Case of departure and recovery

The Air Officer determines the case departure and recovery based upon the existing weather conditions. The table below lists the weather criteria for departures and recoveries.

Weather criteria	Anticipated weather conditions to be encountered by flights during daytime departures and recoveries	Ceiling and visibility in carrier control zone
Case I	Will not encounter instrument conditions	3,000 feet and 5 nm
Case II	May encounter instrument conditions	1,000 feet and 5 nm
Case III*	Will encounter instrument conditions	Less than 1,000 feet and less than 5 nm

*Case III must be used at night for launches and recoveries—1/2 hour after sunset to 1/2 hour before sunrise.

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Departure and recovery restrictions

The following tables provide the restrictions that apply to different departures and recoveries:

If the recovery is:	The departure can be:
Case I	Case I or II only
Case II	Case I or II only
Case III	Case I, II, or III

If the departure is:	The recovery can be:
Case I	Case I, II, or III
Case II	Case I, II, or III
Case III	Case III only

Positive control

Positive control is a form of air traffic control in which the controlling agency has radar and radio contact with the aircraft being controlled. Also, the published approach or departure procedures are being complied with, or the specific assignments regarding heading and altitude are being issued by the controller. Vertical separation is provided by requiring pilots to maintain assigned altitudes or flight levels. Lateral and time separation is the responsibility of the controller. Speed changes may also be directed by the controller.

Positive control must be used in any of the following conditions:

- Ceilings of less than 1,000 feet for fixed-wing operations and less than 500 feet for helicopters
- Forward flight visibility of less than 5 miles for fixed-wing operations or 1 mile or less for helicopters

Continued on next page

Positive control (continued)

- Whenever flight operations are conducted between 1/2 hour after sunset and 1/2 hour before sunrise except as modified by the OTC or the carrier commanding officer
- During mandatory letdown in thunderstorm areas
- In any other situation where supervisory personnel can anticipate weather phenomena that might cause difficulty to pilots

Advisory control

Advisory control is a form of control in which the controlling agency maintains radio and radar contact with aircraft under its control and provides traffic advisories. The pilot maintains traffic separation with the assistance of the controlling agency.

Advisory control must be used when the traffic density in an operating area requires a higher degree of control for the safety of flight than is provided under VFR.

Normally, advisory control is limited to the following situations:

- VMC
- For all operations in or adjacent to oceanic control areas or routes

Monitor control

Monitor control is the monitoring of radar and radio channels for emergency transmissions.

Monitor control must only be used when the following conditions exist:

- Aircraft are operating in VMC,
- Aircraft are operating outside controlled airspace, and
- Separation from other traffic can be safely assumed by the pilot

Nonradar control

Nonradar control must be used when the shipboard radar cannot be used by controllers to provide radar separation under conditions that normally require positive control procedures. The radar may be inoperative or degraded to the point where it is unusable.

Continued on next page

Nonradar control (continued)

The decision to use nonradar control at night or in IMC must be made with careful consideration of factors such as

- Actual meteorological conditions
- Degree of radar degradation
- Expected duration of radar degradation
- Fuel states and tanker fuel available for delays
- Divert field conditions
- Operational requirements
- Departure or recovery in progress
- Availability of other surface or airborne platforms to provide radar separation and approach information

NOTE: The carrier air operations manual shall include procedures used during shipboard systems failures.

Separation Criteria

Introduction

At sea, you will be expected to separate, sequence, and vector aircraft faster and closer than in any other air traffic control environment. To accomplish this task, you must know the lateral and vertical separation criteria established on carriers for use in positive control situations. These restrictions do not apply to tactical maneuvers such as air intercept and rendezvous.

Lateral separation

The following lateral separation is used when aircraft are controlled on carriers:

Degree of control	Aircraft operating situation	Minimum lateral separation required
Positive control by designated air search radar that rotates in excess of 7 rpm	50 miles or more from monitoring antenna	5 miles
	Less than 50 miles from monitoring antenna	3 miles
	On a designated approach or established downwind and inside 10 miles of the ship	2 miles
	Established on final approach within 5 miles of the ship	1 1/2 miles
Positive control by other than designated air search radar	All situations	5 miles
Nonradar control	Using a published approach	2 minutes or 5 miles DME

Continued on next page

Vertical separation

The following vertical separation is used when aircraft are controlled on carriers:

- Jet and turbopropeller (turboprop) aircraft:

Altitude	Minimum required vertical separation
Up to and including FL 290	1,000 feet (may be reduced to 800 feet when the aircraft is within 10 miles of the ship)
Above FL 290	2,000 feet

NOTE: Carrier-based aircraft must fly MSL altitudes below 18,000 feet MSL and flight levels at and above 18,000 feet MSL unless regional supplementary procedures as published in FLIP planning dictate otherwise.

- Helicopters must be separated by 500 feet.

Section D
CATCC Departure Procedures

Overview

Introduction

One of the first essential phases of carrier operations is to get the aircraft airborne and safely on their missions. As a departure controller, you will be responsible for the initial separation of aircraft until handed off to CDC or the pilot is ready to proceed on his or her mission (KILO). Also, you will be directly involved in tanker operations.

In this section

This section consists of the following topics:

Departure Radials

Introduction

During Case II and III departures, one of the means used to provide initial separation of airborne aircraft is the use of departure radials. When working departure control, you must have a thorough understanding of how these radials are used by each squadron.

Assignment of departure radials

Departure procedures are based upon the assignment of TACAN radials to provide for lateral separation. These radials are assigned to squadrons by the air wing and published in carrier air operations manual or air wing doctrine. The minimum standard separation of departure radials is 20°. Normally, all departures are conducted under advisory control with a transition to positive control when necessary, for example, weather, emergencies, pilot request, and so forth.

You normally assign departure radials dependent on the following:

- Mission of the aircraft
- Number of carriers in the formation
- Topographical features in the area
- Those radials reserved for emergencies, letdowns, or helicopter holding

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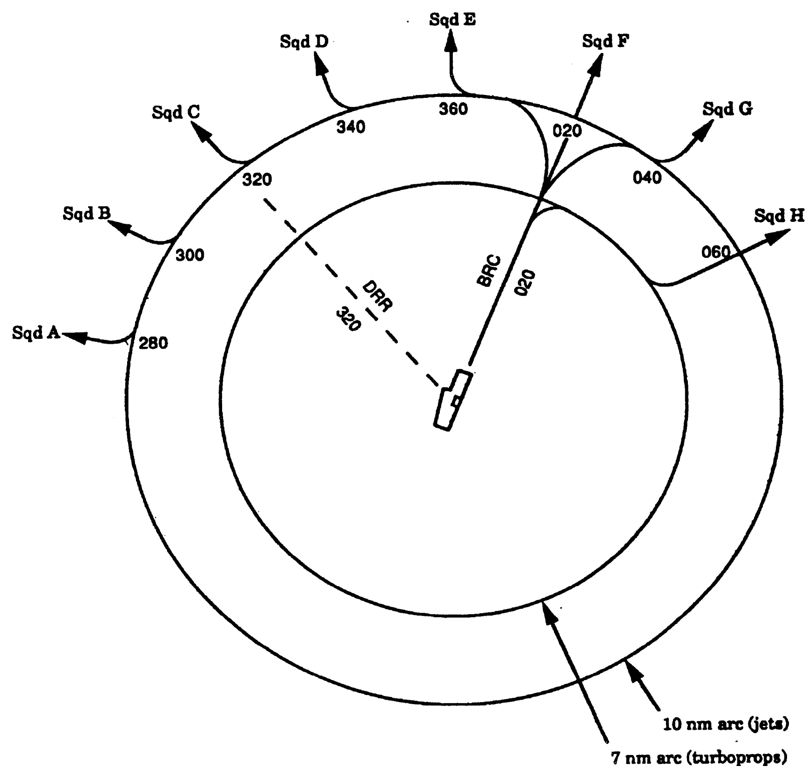
Departure fan and departure reference radial (DRR)

The departure fan displays the radials assigned to each squadron as published in the carrier or air wing doctrine. The fan is based on a TACAN radial assigned by CATCC to which all squadron departure radials are based-the DRR. A departure fan is displayed below.

NOTE: The DRR is provided as part of the prelaunch briefing 2 1/2 hours prior to each event. Although the DRR is normally the same as the expected BRC, the conditions listed in the previous section may cause the DRR to be different than the actual BRC.



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Departure fan and departure reference radial (DRR) (continued)

To accommodate the differences that can occur in the DRR between departures, the air wing assigns departure radials to squadrons in 20 degree increments. For example, squadron A is assigned a departure radial of minus 40 degrees, squadron B a departure radial of minus 20, and squadron C the same as the DRR. Pilots determine their actual departure radial for each launch by adding or subtracting their squadron's assigned departure radial from the DRR. If the DRR is 320 degrees, the actual departure radials for squadrons A, B, and C would be 280, 300, and 320 degrees, respectively.

Squadron	Assigned Departure Radial	Rendezvous altitude
A	-40	Odd
B	-20	Even
C	DRR	Odd
D	+20	Even
E	+40	Odd
F	+60	Even
G	+80	Odd
H	+100	Even

Departure Voice Reports

Introduction

During a launch, you can get pretty busy as a departure controller. To assist you in identifying and tracking departing aircraft, specific voice reports have been established.

Voice reports

The following table lists the standard departure voice reports common for each particular case of departure:

Report	Case II	Case III
AIRBORNE	X	X
PASSING ANGELS TWO POINT FIVE	X	X
ARCING	X	X
Established OUTBOUND	X	X
IMC (POPEYE) with altitude	X	X
ON TOP with altitude	X	X
Mission Readiness (KILO)	X	X

Two of the above voice reports that are not self-explanatory are POPEYE and KILO. POPEYE is a report that indicates that an aircraft is in IMC and is awaiting further instructions. This is the only mandatory pilot voice report. KILO indicates that an aircraft is ready to proceed on its mission.

Departures and Rendezvous

Introduction

During launches, fixed-wing aircraft and helicopters have certain departure procedures to follow. Also, rendezvous guidelines are established for fixed-wing aircraft. Weather is one of the primary factors that determines which departure and rendezvous procedure will be used. Additionally, performance characteristics dictate the initial climbout instructions for certain aircraft.

Departure procedures

The following table lists the departure procedures used in each case of departure:

Weather Criteria	Jet	Turboprop	Helicopter
Case I	After a clearing turn, proceed straight ahead paralleling the BRC at 500 feet until 7 nm. Then, cleared to climb unrestricted in VMC.	Same as jet.	Depart as directed by the tower.
Case II	After a clearing turn, proceed straight ahead at 500 feet paralleling the BRC. At 7 nm, turn to intercept the 10-nm arc and maintain VMC until established on the departure radial. If the aircraft can maintain VMC, the 500-foot restriction is lifted after 7 nm. Jets must maintain 300 knots until VMC on top.	After a clearing turn, parallel the BRC at 500 feet. At 6 nm, turn to intercept the 7-nm arc maintaining VMC until established on the departure radial. Maintain 500 feet until 12 nm on the departure radial.	Depart as directed by the tower.

Continued on next page

Departure procedures (continued)

Table continued from page 11-D-6.

Weather Criteria	Jet	Turboprop	Helicopters
Case III	Climb straight ahead accelerating at 300 knots crossing 5 nm at 1,500 feet or above. At 7 nm, execute a turn to fly the 10-nm arc until intercepting the departure radial.	Climb straight ahead to 1,000 feet accelerating to 250 knots after leveling off. At 5 nm, turn to intercept the 7-nm arc and arc to intercept the departure radial. Maintain 1,000 feet until 12 nm on the departure radial.	Climb straight ahead to 300 feet and arc within 3 miles of the ship to intercept the assigned departure radial.

Rendezvous procedures

Different rendezvous are dictated based on the case departure used.

- Case I—Jet and turboprop aircraft must rendezvous by following air wing doctrine.
- Case II or III—Jet and turboprop aircraft must rendezvous between 20 and 50 miles from the ship on the left side of the departure radial at a prebriefed altitude.

Section E
CATCC Arrival Procedures

Overview

Introduction

The recovery phase of carrier operations is fast-paced and challenging. Inbound aircraft must wait for aircraft to launch from the ship and for the ship's deck to become ready before they can land. Time and aircraft fuel states become very important. However, the whole recovery evolution is a smoothly synchronized event that is accomplished effectively by the various divisions on a ship.

In this section

This section consists of the following topics:

Marshal Procedures

Introduction

Aircraft inbound to a carrier will call CATCC directly, or CATCC will receive a handoff from another agency such as CDC. Then, depending on the case of recovery, aircraft will either proceed directly to the ship or be given marshal instructions. As a marshal controller, you provide pertinent recovery information to inbound aircraft and establish the initial sequencing and separation of aircraft.

Transfer of flights to marshal control (Case II and III)

During Case II and III recovery operations, inbound flights that enter the carrier control area (50-mile radius) are normally turned over to marshal control for further clearance to the marshal pattern. Positive radar identification should be accomplished by the marshal controller before the transfer of control. Control may be transferred only after the marshal controller has notified the transferring controller that positive radar contact exists. Transient helicopters approaching the carrier for landing must contact marshal control when they are at least 25 miles out.

During Case II and III recovery operations, aircraft that were unable to check in with the strike, mission, or marshal control because of communications difficulties should proceed inbound to the emergency marshal at the briefed holding altitude.

Aircraft recovery information

The flight leader should provide you, the marshal controller, with the following information:

- Call sign
- Position
- Altitude
- Lowest fuel state in flight (in hours and minutes for helicopters and pounds for fixed-wing aircraft)
- Total number of aircraft in flight (line-up)
- Type PALS approach requested—if applicable (UTMs sweet or sour—being received or not)
- Other pertinent information, such as navigational aid status, ordnance status, weather, etc., that may affect the recovery of aircraft

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Marshal recovery information

As the marshal controller, you should provide an inbound flight with the following information for a Case III recovery:

- Case recovery
- Type of approach
- Expected FB
- Altimeter setting
- Marshal instructions
- EAT
- Expected approach button
- Time check
- Vector to marshal (if required)
- Multiple marshal stack information (radials/altitudes)

Marshal pattern and marshal fix

During Case I recoveries, aircraft proceed directly to the carrier, and CATCC switches the aircraft to PriFly's frequency when the pilot reports the ship in sight. However, during Case II and III recoveries, aircraft must be placed in a holding pattern. This pattern is called a marshal pattern and is based on a TACAN marshal fix.

A primary TACAN marshal fix is normally established on a predetermined radial at a distance appropriate for the type of aircraft; for example, jet, turboprop, or helo. The radial is established with reference to the expected FB. The FB is the extended-landing-area centerline. The marshal fix is similar to the IAF on an instrument approach to a naval air station.

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Jet/Turboprop marshal

For jet and turboprop aircraft, the primary TACAN marshal fix is normally on the 180° radial relative to the expected FB at a distance of 21 miles plus 1 mile for every 1,000 feet of altitude. The base altitude will be as assigned but not lower than 6,000 feet. The holding pattern is a left-hand 6-minute racetrack pattern. The inbound leg must pass over the holding fix. The following table lists the altitudes and DME for a standard CV-1 marshal pattern:

Altitude Assignment (in feet)	Distance of Aircraft	
	Case II	Case III
6,000		21 DME
7,000	22 DME	22 DME
8,000		23 DME
9,000	24 DME	24 DME
10,000		25 DME
11,000	26 DME	26 DME
12,000		27 DME
13,000	28 DME	28 DME
14,000		29 DME
15,000	30 DME	30 DME
16,000		31 DME
17,000	32 DME	32 DME
18,000		33 DME
19,000	34 DME	34 DME

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Jet/Turboprop marshal (continued)

During Case II recoveries, an altitude block is left vacant in case the aircraft do not get the ship in sight by 5 miles. In this situation, the recovery would shift to a Case III recovery, and a vacant altitude is available to split up aircraft flights into single aircraft at each altitude.

Helicopter marshal

The primary TACAN marshal for helicopters is the 110° radial relative to the expected FB at a distance of 1 mile for every 500 feet of altitude starting at 1,000 feet and 5 miles. The holding pattern is a right-hand racetrack pattern with 2-nm legs. The inbound leg must pass over the holding fix.

Emergency marshal

Fixed-wing aircraft are issued an emergency marshal radial before launch should radio failure occur. Normally the emergency marshal radial is 150° relative to the expected FB at a distance of 15 miles plus 1 mile for every 1,000 feet of altitude (Angels + 15). For example, an aircraft that will hold at 14,000 feet would be assigned 29 DME.

Jet/turboprop aircraft must not be assigned an altitude below 6,000 feet. The holding sequence is jets first and turboprops second. The holding pattern is a right-hand 6-minute racetrack pattern with an inbound leg that passes over the holding fix.

The helicopter emergency marshal radial is the same as the normal helicopter marshal radial with emergency holding normally commencing at 7 miles.

Overhead marshal

An overhead marshal should be used when geographical considerations or operational circumstances dictate. The assigned inbound magnetic heading to the holding fix should coincide with the outbound magnetic radial of the approach. If overhead marshal is used as the emergency marshal fix, EEATs from the overhead marshal should be every other minute.

En route radar approach (random)

When an aircraft or flight cannot reach the assigned marshal point in time to make an assigned approach time, because of mission, fuel state, or ordnance load, you may have to use radar vectors to place the flight in the proper approach sequence. Positive radar control is required. Whenever possible, you should provide the pilot with a brief description of the intended penetration.

Continued on next page

Marshal altitude assignment and separation

You should make every effort to anticipate the weather conditions and provide marshaling in visual conditions, if practical. Aircraft below an overcast cloud layer should not be required to climb into the overcast to comply with the marshal altitude limits if the marshal controller can maintain the interval and sequence from the lower altitude. Aircraft above an overcast cloud layer should be assigned altitudes above the overcast and be retained in formation where possible.

You should limit formation flights to a maximum of four aircraft at any one assigned altitude. Under instrument conditions, a section of two aircraft is the maximum number authorized in any one flight and hence at the same marshal altitude.

Normally, you should assign fixed-wing aircraft marshal altitudes that provide a 1,000-foot vertical separation. Helicopters are assigned altitudes at marshal that provide a 500-foot vertical separation.

NOTE: When the flights of two aircraft are held at marshal during instrument conditions, it is advisable to provide vertical separation of 2,000 feet between flights. This procedure makes sure that you can provide the required 1,000 feet of vertical separation if a flight must be split.

Approach Procedures

Introduction

Different types of approaches have been developed for carriers based on aircraft performance characteristics and the location from which an instrument approach will commence. As a shipboard controller, you must have a comprehensive knowledge of these approaches so you know what actions a pilot will take when he or she makes an approach.

Approach weather minimums

The commanding officer of a carrier can modify the approach weather minimums for his or her ship. Certain situations such as the decreased proficiency of a CATCC team or an embarked air wing can dictate a change in these minimums. However, the following table lists the absolute minimums authorized for carrier instrument approaches:

Aircraft Type	Type of Approach	Weather Minimums (ceiling and visibility)
Jet	Nonprecision	600 feet and 1 1/4 miles
	ICLS	300 feet and 3/4 mile
	ICLS/ILM with SPN-42 or SPN-46 monitor	200 feet and 1/2 mile
	Mode I	As certified
	Mode IA, II, IIT, III	200 feet and 1/2 mile
Turboprop	Nonprecision	400 feet and 1 mile
	ICLS	300 feet and 3/4 mile
	ICLS/ILM with SPN-42 or SPN-46 monitor	200 feet and 1/2 mile
	Mode II, IIT, III	200 feet and 1/2 mile
Helicopter	Nonprecision	300 feet and 3/4 mile
	Mode III	200 feet and 1/2 mile

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Approach weather minimums (continued)

NOTE: PALS Mode I qualified aircraft *without* an operating ILM may be certified to minimums of 200-foot ceiling and 1/2-nm visibility.

PALS Mode I qualified aircraft *with* an operating ILM display may be certified to minimums less than 200-foot ceiling and 1/2-nm visibility.

Type of approach

One of the controlling factors that determines where a marshal pattern will be located is the type of approach. The following table lists the different types of approaches available:

Type of approach	Type of aircraft	Type of procedure
CV-1	Jet & Turboprop	Straight-in
CV-2	Jet & Turboprop	Overhead
CV-3	Helicopter	Offset

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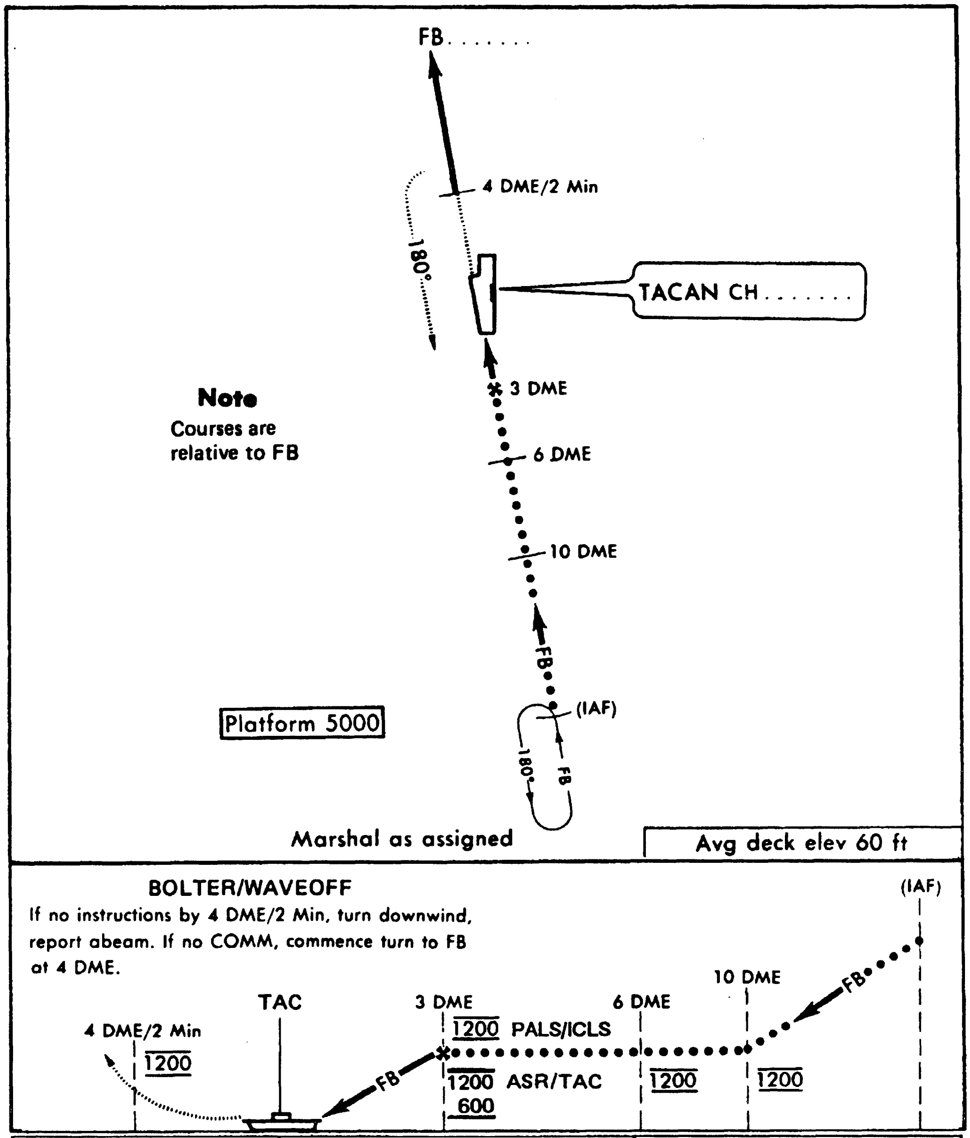
Type of approach (continued)

A CV-1 approach is displayed below.



CATEGORY	JET	TURBOPROP
ICLS	360-3/4	300 (300-3/4)
ICLS/ILM with SPN-42/46 monitor S—PALS	(Mode 1 — As Certified) 260-1/2	200 (200-1/2)
S—ASR S—TAC	600-1-1/4 540 (600-1-1/4)	400-1 340 (400-1)

PALS Approaches

Introduction

One of the most critical phases of an instrument approach is the final approach segment. As a final controller on a carrier, you will use PALS equipment to provide control and guidance information to landing aircraft. The mode of approach determines what information you will give a pilot. Both precision and nonprecision approaches are available.

Precision final approaches

Jet and turboprop aircraft pass through the 6-mile DME fix at 1,200 feet at 150 knots in landing configuration and commence slowing to final-approach speed. Unless otherwise directed by the final controller, the altitude of 1,200 feet is maintained at approach speed until the glide path is intercepted (approximately 3 miles dependent upon the glide slope angle).

Helicopters pass through the 3-mile DME fix at 500 feet in landing configuration. They maintain 500 feet until interception of the glide path or until otherwise directed by the final controller.

PALS modes of aircraft control

PALS approaches differ by the type of control given (automatic or manual) and how the information is relayed (display or voice). The following table lists the different modes of PALS approaches and their type of control:

PALS Mode	Type of Control
Mode I	Fully automatic approach to touchdown
Mode IA	Automatic approach to 1/2 mile
Mode II	Manual approach with PALS glide slope and lineup error information provided to the pilot by cockpit display
Mode IIT	Manual approach with control information provided by both display and voice (final controller)

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PALS modes of aircraft control (continued)

Table continued from page 11-E-10.

PALS Mode	Type of Control
Mode III	Manual approach with information provided by the final controller

Mode I approach

A Mode I approach is a fully automatic approach to touchdown. At the 6-mile DME fix, the pilot should engage the APC and AFCS. Normally at between 4 and 8 miles, the pilot receives via data link a LANDING CHECK discrete signal to indicate positive data link communications between the aircraft and the ship.

The controller acquires the aircraft between 3.5 and 8 miles, and the READY/LOCKON discrete light illuminates. At that time, the controller must report lockon with range, verify needles, and issue instructions as necessary for the aircraft to intercept the centerline, and instruct the pilot to report coupled. For example: "201 lockon, 5 miles, right ten, say needles."

Needles must be verified before the "Report Coupled" instructions are given by the final controller. With the aircraft in straight and level flight, within 10 knots of approach speed, and with a fly-up indication on his or her glide slope indicator, the pilot should engage autopilot coupler and report "Coupled."

If the aircraft is unable to couple, the controller should continue with a Mode II or III approach.

The controller must report sending commands. The illumination of the COMMAND CONTROL discrete light indicates that the aircraft is receiving command signals via data link. The pilot must acknowledge receipt of data link commands by reporting "Command control." Thirty seconds of coupled flight is desired prior to intercepting the glide path.

Continued on next page

Mode I approach (continued)

The controller should advise the pilot when he or she is approaching glide path and may advise him or her of range each mile. The controller must advise the pilot at minimums unless the LSO has previously assumed responsibility. The pilot responds with a ball report and includes the word "Coupled." For example: "201 Hornet ball, five point three coupled."

Mode IA approach

A Mode IA approach is automatic to approach minimums with manual takeover to touchdown. Mode IA approaches are conducted the same as Mode I approaches except the pilot uncouples at or before reaching the approach minimums and reports "Uncoupled." If the pilot uncouples at the ball call, he or she includes the word "Uncoupling" in the ball report. For example: "201 uncoupling, Hornet ball, five point three, manual/auto." When the pilot reports uncoupling, the controller must downgrade the PALS to Mode II.

Mode II approach

A Mode II approach is a manual approach by the use of ILS-type (crossed needles) instrument presentation. Mode II approaches are conducted the same as Mode I/IA until receipt of the READY/LOCKON discrete light.

Then the controller must report lockon with range, verify needle presentation, and issue instructions to intercept the centerline. For example: "201 lockon, 5 miles, right ten, say needles." The pilot must report needle position. For example: "201 needles up and right." The controller must concur or downgrade the approach to Mode III and advise the pilot. For example: "201, concur" or "201, disregard needles, downgrade to Mode III."

The controller must monitor the approach, advise the pilot when approaching the glide path, and should inform him or her of the range at each mile. The controller must advise the pilot when at minimums unless the ESO has previously assumed responsibility. The pilot responds with a ball report.

Mode IIT approach

A Mode IIT approach is a manual approach using needles instrument presentation with Mode III information. This is a training approach used to build pilot confidence in Mode II approaches.

Continued on next page

Mode III approach

A Mode III approach is a CCA talk-down approach with no requirement for special aircraft configuration. The controller must advise the pilot when the aircraft is at minimums unless the LSO has previously assumed responsibility.

Nonprecision approach

A nonprecision approach is conducted when a precision radar approach or suitable visual landing aids are not available. An aircraft on final approach continues its descent to 600 feet after passing the (6-mile DME fix. As the final controller, you must provide sufficient information to the pilot to maintain an accurate azimuth and altitude until reaching nonprecision minimums.

ICLS approach

The ICLS, or *bullseye,* is an ILS-type of system that uses the ILM and TACAN/DME. It provides the same type of information that PALS provides; however, CATCC receives no visual indication on the type of information sent to the aircraft. A pilot can also use the ICLS for two additional purposes.

- To aid in positioning the aircraft for PALS radar acquisition
- As an independent monitor of aircraft approach performance during a PALS approach

Helicopter recoveries

Normally, a carrier recovers helicopters after it recovers all fixed-wing aircraft. When helicopters finish night plane guard duties, CATCC provides the helicopters with the positioning information they need to quickly intercept the glide path and land.

During IMC recoveries, the pilot must fly a Mode III approach until he or she acquires visual contact with the optical landing aids. At which time he or she must report "Ball." Control is then assumed by the air officer, who issues final landing clearance. If a waveoff occurs, the pilot must parallel the FB course and report to CATCC for control.

DELTA Procedures

Introduction

Sometimes, it is necessary to delay a recovery because the ship's deck is not ready for the landing of aircraft due to such things as an emergency or the launch not being complete. In these type situations, the CCA officer or CATCC supervisor may direct the marshal controller to issue a signal *DELTA* to inbound and holding aircraft.

DELTA responsibilities

During Case I flight operations, PriFly gives the *DELTA* signal to recovering aircraft when necessary. During Case II or III flight operations, CATCC issues *DELTA* signals as required.

DELTA signal composition

The *DELTA* signal consists of the word *DELTA* and a number suffix indicating the number of minutes that the recovery is expected to be delayed. *DELTA* delays are always given in even numbers and never given for less than four minutes. For example, if a 6 minute delay is necessary, the marshal controller would issue a *DELTA SIX*.

Aircraft actions

An aircraft's position at the time a *DELTA* is issued determines what actions a pilot will take.

- **Aircraft in the marshal pattern** remain in the holding pattern and await the assignment of a new EAT.
- **Aircraft that have already commenced an approach but are above 7,000 feet** level off at the next lower odd altitude and hold on the inbound bearing at a range in nm equal to the holding altitude in thousands of feet plus 15 (angels + 15). The aircraft hold by using a 6-minute racetrack pattern and await assignment of a new EAT. Aircraft that have re-entered holding at the next odd altitude must report when they are established in holding with the new altitude.
- **Aircraft that have already commenced an approach but are at or below 7,000** feet continue the approach and await further instructions.

All aircraft are required to acknowledge the receipt of new EATs.

Section F
Tanker Operations

Overview

Introduction

Tanking (aerial refueling) is an important aspect of carrier operations. In many cases, aircraft on or returning from a mission require additional fuel to return and land safely on a carrier. Also, having sufficient fuel becomes critical when the only available landing area is the ship itself because a suitable land base is outside the flying range of an aircraft. As a departure controller, you will be actively involved in tanker operations and monitoring fuel states.

In this section

This section consists of the following topics:

General Tanking Procedures

Introduction

Tanker aircraft are assigned duties in support of the recovery of aircraft. Normally, a tanker that has just been launched becomes the duty tanker for the recovery that follows immediately provided that the tanker's store is operational. Those tankers that are known to have a good store and sufficient fuel to meet receiver requirements display a flashing green light.

Tanker control responsibilities

A specific agency (normally departure control) is designated as tanker control. Tanker control monitors the following:

- Tanker give-away fuel
- Tanker location
- Location and fuel requirements of the low fuel state aircraft (low-state aircraft)
- Coordination of the tanker and receiver rendezvous

Tanking Terms

Introduction

To understand tanker operations, you must know the meaning of certain tanking terms. You will use these terms as a departure controller to relay tanking information.

Terms and their meanings

The following table contains commonly used tanking terms and their meanings:

Term	Meaning
Give	The amount of fuel the tanker has to transfer to other aircraft.
Hawk	An order given to a tanker pilot to visually acquire a low-state aircraft that is on approach to the ship and position the tanker to rendezvous immediately with the aircraft if it bolters or waves off.
Package	A tanker's refueling system.
Plugged and Receiving	The refueling probe is in the drogue of the tanker's refueling hose and properly taking on fuel.
Sour	A tanker's fuel package will not transfer.
State	Same as fuel state. The amount of fuel of an aircraft expressed in pounds for fixed-wing aircraft and hours and minutes for helicopters.
Sweet	The refueling system is functioning properly.
Trick or Treat	An instruction issued to the tanker pilot that advises him or her that a particular aircraft requires fuel if it bolters. Normally, the number of pounds required to transfer accompanies the instruction, for example, "trick or treat for two."

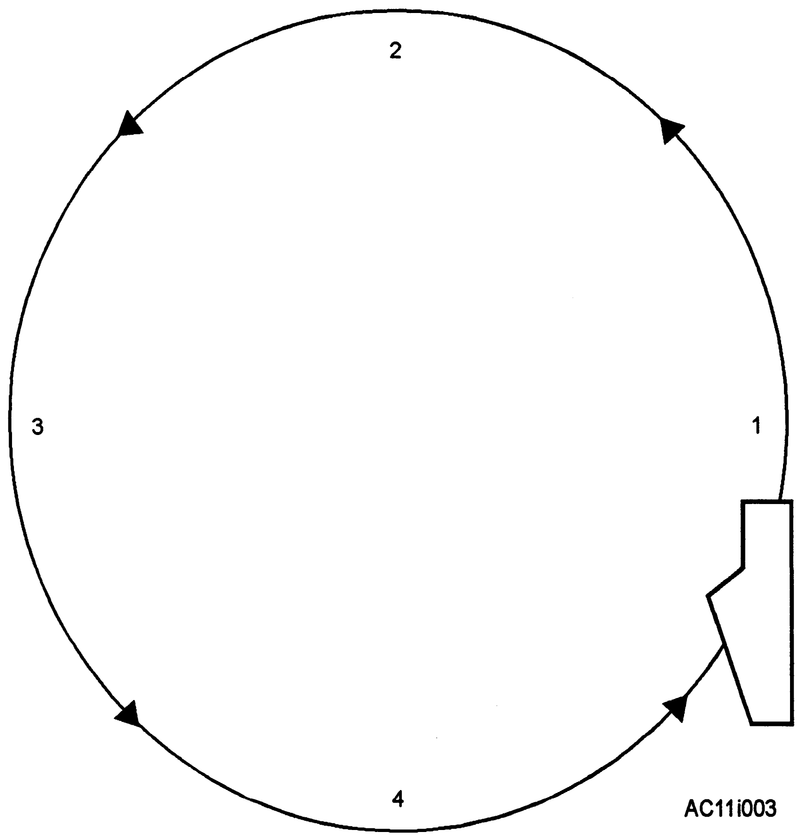
Tanker Patterns

Introduction

Certain factors determine the altitude and type of pattern a tanker aircraft is required to fly. As a departure controller, you must know these factors and the patterns that will be flown.

VMC rendezvous circle

After an oncoming tanker's package checks sweet, it will enter a rendezvous circle pattern oriented on the carrier. The pattern has four reference points. The tanker pilot and the departure controller use these points to indicate the position of the tanker in relation to a potential receiving aircraft.



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VMC tanker pattern altitudes

The table below lists the VMC recovery tanker pattern altitudes:

Tanker pattern during launch and recovery operations—VMC duty	Minimum altitude
Left-hand circle within 5 nm from the carrier	Day—1,500 feet
	Night—2,500 feet

IMC tanker pattern altitudes

The table below lists the IMC recovery tanker pattern altitudes:

Tanker pattern during launch and recovery operations—IMC duty	Minimum altitude—day and night
Left-hand circle within 5 nm from the carrier	2,500 feet or higher *and* 1,000 feet above an overcast cloud layer or VMC between cloud layers

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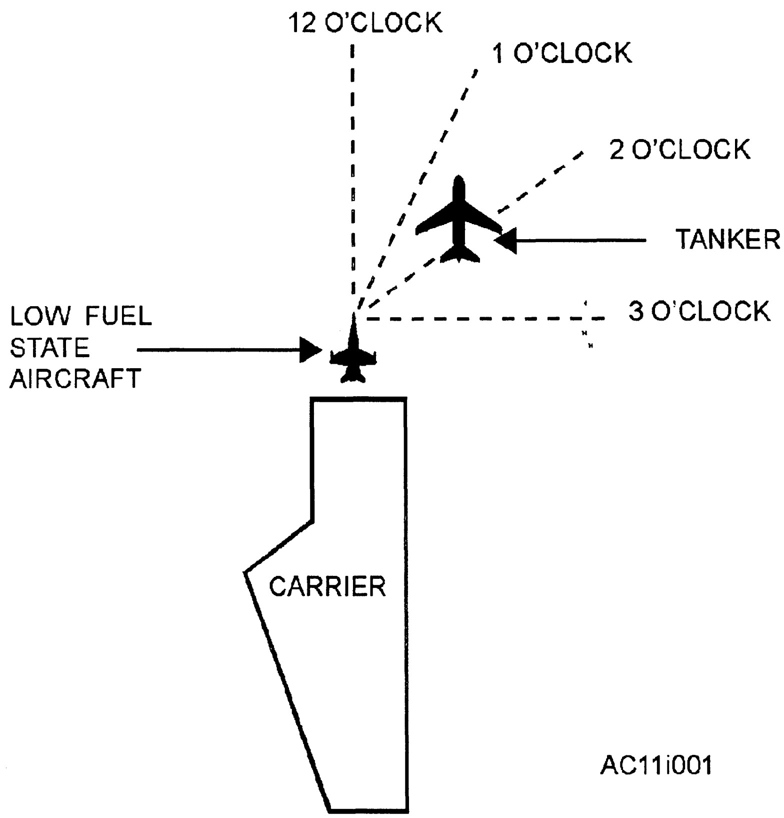
Rendezvous low pattern

If the tanker is instructed to *hawk* a low fuel state aircraft, the tanker pilot must adjust the tanker pattern. The pilot must position the tanker so that the tanker aircraft is at the 2 o'clock position of the hawked aircraft if and when the hawked aircraft bolters/waves-off. This pattern adjustment places the tanker in an easily accessible acquisition position for the hawked aircraft. The minimum altitude for the rendezvous low pattern is 1,500 feet during the day and 2,500 feet at night.



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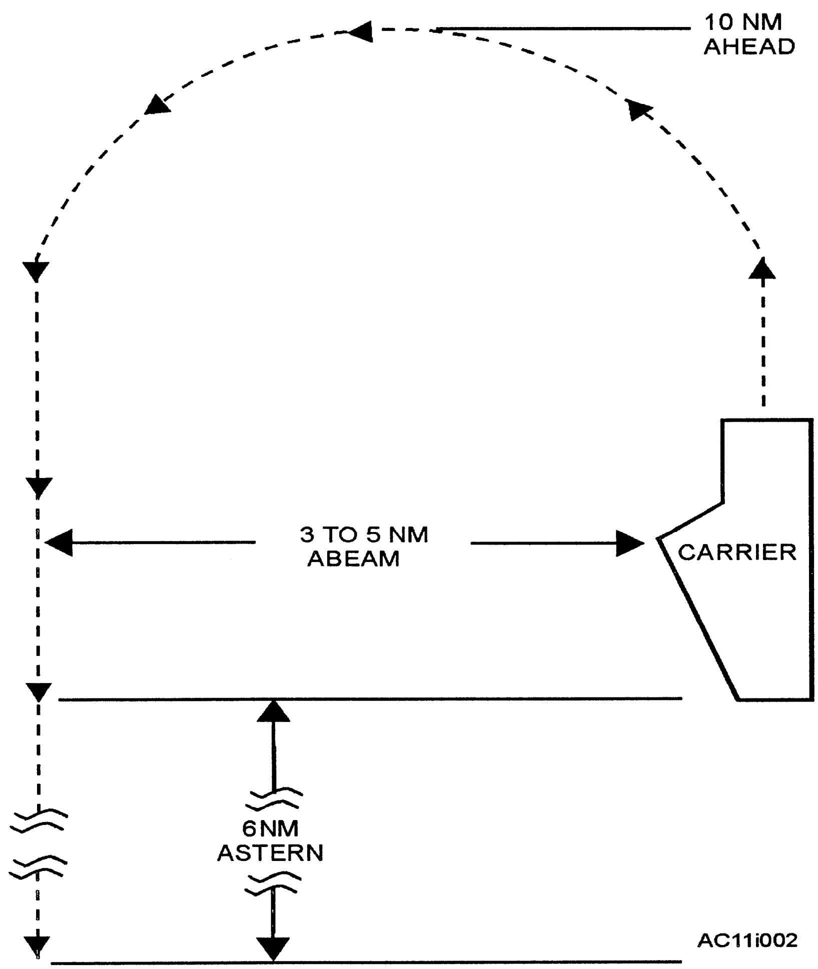
Receiver engaged pattern

Once the hawked aircraft, now called receiving aircraft, successfully engages the tanker's refueling probe, the tanker establishes itself and the receiving aircraft in a racetrack pattern in the vicinity of the ship. Normally, the tanker should not proceed more than 10 nm ahead of the ship. The downwind leg of the pattern should be 3 to 5 miles abeam the ship, and the tanking evolution should be completed before the tanker and receiving aircraft reach a point 6 miles astern the carrier. The 6-mile-astern position places the receiving aircraft in the proper position to reenter the CCA recovery pattern.



Section G
Amphibious ATC Scope

Overview

Introduction

On an LHA or LHD, a majority of the duties performed by air traffic controllers takes place in the AOCC by ship's company personnel or in the TACC by TACRON personnel. AOCC and TACRON personnel provide either air control or mission control services in support of air operations.

In this section

This section consists of the following topics:

AOCC and TACRON Descriptions

Introduction

AOCC and PriFly are responsible for air traffic control functions and the control of all air traffic operating in the control area. Control functions are delegated as follows:

- PriFly is responsible for the visual control of aircraft within the control zone.
- AOCC controls aircraft in the control area during departure, recovery, and en route.
- TACRONs provide the mission control services to aircraft in an AOA/AOR.

AOCC description

AOCC is under the direction of the AirOps officer. AOCC assumes control of aircraft after launch and retains control of aircraft until they are transferred to a mission controller. AOCC resumes control after aircraft complete their missions and retains control of aircraft until control can be assumed by PriFly, an LSE, or an LSO.

TACRON description

Mission control functions are performed by a TACRON. Mission control involves the direction and assistance to aircraft during the execution of their tactical mission. A TACRON is responsible for mission control of all aircraft operating within an AOA/AOR until control can be safely assumed by a shore-based or airborne forward controller. In addition, a TACRON often assumes an operational role and may take control of aircraft that operate within the control area. TACRON controllers work in the TACC.

AOA/AOR

An AOA/AOR is a geographic area to be secured by an amphibious task force. The initiating objective defines the specific area. The area is large enough for the sea, air, and land operations to accomplish the mission.

AOCC Operating Positions

Introduction

ACs who are assigned to an AOCC perform ATC functions similar to those performed by their CATCC counterparts on a carrier.

AOCC officer

The AOCC officer performs the functions of an ATCF officer. Unlike the facility officers on shore duty and in CATCCs, the AOCC officer is a pilot and does not have ATC experience.

AOCC supervisor

The AOCC supervisor supervises the AOCC during flight operations and the preparations of the center that lead to flight operations. The AOCC supervisor is responsible to the AOCC officer for the safe conduct of flight operations and for all ATC services provided.

Marshal control

During Case I, II, and III recoveries, marshal control controls inbound aircraft. Control begins at a pilot's check-in position and continues until aircraft handoff to PriFly during Case I recoveries or approach control during Case II and III recoveries. Additional marshal control duties include:

- Providing arrival information
- Establishing the initial interval between recovering aircraft
- Monitoring the start of an aircraft's approach until its handoff to another agency or controller

Approach control

Approach control controls aircraft on approach during Case II and III recoveries. Control is provided from the handoff from marshal control to "SEE ME" during Case II conditions and until transfer to final control during Case III conditions. However, approach control is responsible for separation after transfer to final control during Case III recoveries. Additional approach control duties include:

- Spacing and creating holes for waveoff and missed approach aircraft
- Providing separation between aircraft under their control
- Ensuring the first aircraft meets the assigned charlie time

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AOCC Operating Positions, Continued

Assault control

Assault control duties vary with the tactical situation. The following list contains the major assault control functions:

- Monitoring or assisting in assault wave formation
- Directing the wave or flights within the AOA/AOR until the wave or flights are handed off to a mission controller
- Plotting CPs
- Adjusting aircraft times and speeds to ensure timely arrival of aircraft at the landing zone
- Performing handoffs with other control position and agencies as necessary

NOTE: Due to radio frequency and airspace limitations, assault control is normally combined with departure control

Departure control

Departure control controls departing aircraft during Case I, II, and III conditions. Specific departure control duties include:

- Provides radar vectors to departing aircraft
- Monitors departures to ensure aircraft fly established procedures
- Provides flight following to departing aircraft until handoff to the appropriate control position or agency or the aircraft report"feet dry"

Final control

Final control controls aircraft on final approach. Final control receives handoffs from the approach controller and maintains control of an aircraft until assumption of control by PriFly, an LSE, or an LSO.
Final control duties include:

- Provides azimuth and glide slope lineup before the LSE or LSO assumes control of an aircraft or the aircraft reaches approach minimums.
- Assists in maintaining aircraft separation on final. Primary responsibility lies with the approach controller.

TACC Functional Areas

Introduction

The TACC is broken down into five functional areas:

- Air Traffic Control Section (ATCS)
- Air Support Control Section (ASCS)
- Anti-Air Warfare Section (AAWS)
- Plans and Support Section (PSS)
- Helicopter Coordination Section (HCS)

Since the AAWS section is usually manned by Operations Specialists (OSs) not ACs, this section is not covered in this training manual.

ATCS

The ATCS controls and coordinates aircraft entering, operating within, or transiting an AOA/AOR or other assigned operating area. It also coordinates SAR operations. ACs provide advisory control of aircraft within an AOA/AOR and maintain separation as needed.

ASCS

ACs assigned to the ASCS exercise operational control and coordination of all helicopter and V/STOL aircraft assigned to troop support missions. Some additional responsibilities include:

- Advising the Supporting Arms Coordination Center (SACC) on the use of CAS aircraft
- Evaluating and coordinating Tactical Air Requests (TARs)
- Receiving and consolidating daily air support requirements for the Air Tasking Order (ATO)
- Relaying emergency requirements for CAS aircraft to the responsible agencies

Continued on next page

TACC Functional Areas, Continued

PSS

The PSS provides all communications support and conducts all current and future planning by providing charts, publications, personnel, and equipment to assemble and distribute current air operations data and reports.

HCS

The HCS coordinates helicopter operations conducted by the AOCC and other subordinate agencies. ACs normally serve as Helicopter Coordinator Assistants and aid the Helicopter Coordinator (HC) in the supervision of the HCS and advising the TACC/SACC of the employment of helicopters. Additional responsibilities include:

- Evaluating and redirecting helicopters as required by the CATF and the CLF
- Evaluating support requests received over the helicopter and administrative nets
- Maintaining status on helicopter assaults taking place during the ship-to-shore movements
- Scheduling VIP helicopter movements
- Acting as SAR coordinator and coordinating with SACC

TACC Operating Positions

Introduction

TACRON ACs perform a variety of duties when assigned to a TACC. Some of these duties are clearly established and broken down into operating positions.

TACC Supervisor

The TACC supervisor directs the ATCS watch team and oversees personnel who control the flow of air traffic in the AOA/AOR.

Tactical air traffic controller (TATC)

A TATC controls aircraft in the AOA/AOR. The TATC has the following duties:

- Checks and authenticates all aircraft entering the AOA/AOR and ensures that the following information is received:

  –Aircraft call sign
  –Number and type of aircraft
  –Position and altitude
  –Mission number
  –Time on station
  –Ordnance or fuel to give

- Provides local altimeter settings and restrictions that apply to special flight areas
- Directs aircraft to a CP and changes altitude as necessary to maintain separation
- Ensures aircraft are forwarded to mission coordinators
- Ensures that the TACC supervisor is informed of asset status and availability
- Directs aircraft to an entry or exit point or tanker track and assigns each aircraft an altitude that ensures proper separation

Continued on next page

Tactical air direction (TAD) controller	A TAD controller has the following responsibilities: • Controls all aircraft assigned by the TATC, TACC supervisor, or AASC • Assigns missions and targets as directed • Briefs flight leaders on assigned missions • Records and disseminates bomb damage assessments (BDAs) • Transmits air raid warning conditions • Keeps supervisory personnel informed of the status of all aircraft under TAD control
Tactical air request/helo request (TAR/HR) operator	The TAR/HR operator performs the following functions: • Maintains communications with Marine control agencies ashore • Receives, records, and relays requests for air support missions • Relays results of air missions to appropriate authorities • Passes air raid warning conditions to ashore units • Receives front-line position and ground situation reports for relay to appropriate authorities

Section H
Amphibious Control Criteria

Overview

Introduction

While similar to carrier operations, amphibious operations have different control procedures and separation standards. You must have a comprehensive knowledge of these procedures and standards to provide safe and expeditious air traffic control service on an LHA or LHD.

In this section

This section consists of the following topics:

Control Procedures

Introduction

Existing weather in the ship's control area and control zone is the most prominent factor affecting the type of departure and/or recovery. Just like carrier operations, the three types of departure and recovery operations are Case I, II, or III. The Air Ops officer determines the case of operations to use during departure and recovery operations. The AOCC/HDC exercises one of four degrees of control-close control, advisory control, monitor control, or nonradar control.

Case of departure and recovery

The Air Ops Officer determines the case departure and recovery based upon the existing weather conditions. The table below lists the weather criteria for departures and recoveries.

Weather criteria	Anticipated weather conditions to be encountered by flights during daytime departures and recoveries	Ceiling and visibility in carrier control zone
Case I	Will not encounter instrument conditions	3,000 feet and 5 nm (V/STOL) 1,000 feet and 3 nm (helo)
Case II	May encounter instrument conditions	1,000 feet and 5 nm (V/STOL) 500 feet and 1 nm (helo)
Case III*	Will encounter instrument conditions	Less than 1,000 feet and less than 5 nm (V/STOL) Less than 500 feet and less than 1 nm (helo)

*Case III must be used at night for all V/STOL operations.

Continued on next page

Departure and recovery restrictions

The following table provides the restrictions that apply to different departures and recoveries:

If the recovery is:	The departure can be:
Case I	Case I only
Case II	Case I or II only
Case III	Case I, II, or III

If the departure is:	The recovery can be:
Case I	Case I, II, or III
Case II	Case II or III
Case III	Case III only

Close control

With close control, the controlling agency has radar and radio contact with the aircraft being controlled. Also, the aircraft complies with published approach or departure procedures or with specific assignments regarding heading and altitude that the controller issues. The controller may also direct speed changes.

Close control applies when the following conditions exist:

- Ceiling of 1,000 feet or less for V/STOL operations
- Ceiling of 500 feet or less for helicopter operations
- Forward flight visibility of less than 5 nm for V/STOL operations
- Forward flight visibility of 1 nm or less for helicopter operations
- All flight operations between 1/2 hour after sunset and 1/2 hour before sunrise except as modified by the OTC or ship's commanding officer
- During mandatory letdown in thunderstorm areas

Continued on next page

Close control (continued)

- In other situations where supervisory personnel can anticipate weather phenomena that might cause difficulty to pilots

NOTE: The helicopter night touch-and-go pattern is excluded from close control provided that a visible horizon exists.

Advisory control

Advisory control must be used when the traffic density in the operating area requires a higher degree of control for safety of flight than required under visual flight rules.

Normally, advisory control is limited to the following situations:

- VMC
- For all operations in or adjacent to oceanic control areas or routes

Monitor control

The monitoring of radar and radio channels for emergency transmissions is monitor control.

Monitor control must only be used when:

- an aircraft is operating in VMC outside of controlled airspace, and
- separation from other traffic can be safely assumed by the pilot.

Nonradar control

Nonradar control must be used when the shipboard radar is inoperative or so degraded as to be inadequate to provide radar separation of air traffic under conditions that normally require close control.

The decision to attempt control of aircraft at night or in instrument flight conditions must be made with careful consideration of factors such as the following:

- Actual meteorological conditions
- Degree of radar degradation
- Expected duration of radar degradation

Continued on next page

Nonradar control (continued)

- Fuel states and fuel available for delays
- Divert field suitability and availability
- Operational requirement
- Departure and recovery in progress at the time a nonradar environment develops
- Availability of other surface or airborne platforms to provide radar traffic separation and approach information

Separation Criteria

Introduction

Specific separation standards apply to amphibious aircraft operations. You will use these standards to separate, sequence, and vector aircraft to and from ships. These separation standards do not apply to tactical maneuvers such as air intercept rendezvous.

Lateral separation

The following lateral separations are used for amphibious operations:

Type of control	Aircraft operating situation	Minimum lateral separation required
Positive control by designated air search radar	50 miles or more from monitoring antenna	5 miles
	Less than 50 miles from monitoring antenna and not within 10 miles on a designated approach	3 miles
	On a designated approach inside 10 miles of the ship	2 miles
	Established on final approach within 5 miles of the ship	1 1/2 miles
Positive separation via nonradar control	Using a published approach	2 minutes or 5 miles DME

Continued on next page

Separation Criteria, Continued

Vertical separation

The following vertical separation is used when aircraft are controlled on amphibious ships:

- Jet and turbopropeller (turboprop) aircraft:

Altitude	Minimum required vertical separation
Up to and including FL 290	1,000 feet
Above FL 290	2,000 feet

- Helicopters:

Situation	Minimum required vertical separation
Between helicopters	500 feet
Between helicopters and fixed-wing aircraft	1,000 feet

Section I
Amphibious Departure Procedures

Overview

Introduction

Helicopters and V/STOL aircraft have different departure procedures. When you are working the departure control position on an amphibious ship, you are tasked with ensuring that all aircraft follow their established departure routes.

In this section

This section consists of the following topics:

Helicopter Departure Procedures

Introduction

As a departure controller, you work with Case I, II, and III helicopter departures. During departures, you must not require that a pilot change radio frequencies or IFF codes until the helicopter attains at least a 300-foot cruise configuration.

Helicopter departure procedures

The following table lists the helicopter departure procedures used in each case of departure:

Weather Criteria	Departure Procedure
Case I	Helicopter pilots clear the control zone at or below 300 feet or as directed by PriFly.
Case II	Helicopters depart via Case I departure procedures and maintain flight integrity below the clouds. Weather conditions permitting, helicopters also comply with Case I procedures when they depart on their assigned missions. If helicopter pilots are unable to maintain VMC, they must proceed according to Case III departure procedures.
Case III	Helicopters launch at not less than 1-minute intervals, climb straight ahead to 500 feet, and intercept the 3-mile arc. They arc at 3 miles to intercept assigned departure radials. Upon reaching their assigned departure radials, helicopters turn outbound and commence climbing to their assigned altitudes. The minimum standard separation of departure radials is 20 degrees.

NOTE: Helicopters rendezvous at briefed points according to squadron tactical doctrine.

Continued on next page

Additional helicopter Case III departure procedures

Some other helicopter specific Case III departure procedures include:

- Case III departures apply whenever weather conditions at the ship are below Case II minimums, when there is no visible horizon, or when directed by the commanding officer or OTC.
- Helicopters launch on the assigned departure radio frequency instead of the land/launch frequency and monitor guard frequency. PriFly monitors the departure frequency.
- Helicopters that launch on tactical missions rendezvous as briefed, report KILO, and switch to an assigned tactical control agency.
- Similar types of aircraft may launch at 1-minute intervals. If radar contact is established within 1 mile after takeoff, AOCC may clear the next aircraft to depart. During mixed operations, there must be a 2-minute interval between the last helicopter and the first V/STOL aircraft.

NOTE: Modifications to Case III procedures are not authorized.

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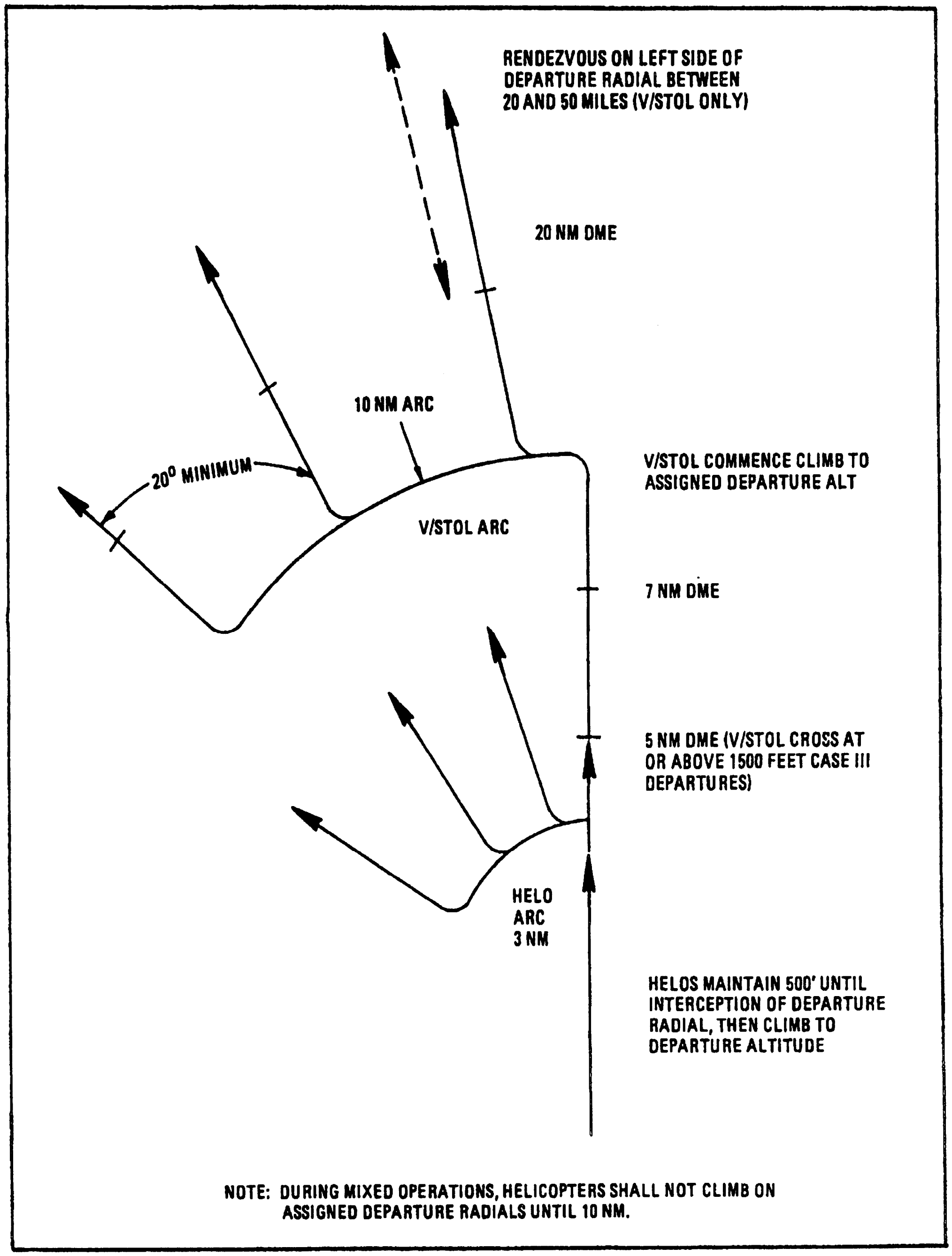
Departure patterns

Standard amphibious IMC departure patterns are depicted below:



V/STOL Departure Procedures

Introduction

Due to mission and aircraft characteristic differences, V/STOL aircraft use different departure procedures than helicopters. As a departure controller, you must know these departure procedures and monitor aircraft compliance.

General

For V/STOL departures, advisory control is normally used with a transition to close (positive) control when necessary. Situations that would require close control include the following:

- Weather conditions
- Pilot request
- Failure to comply with departure procedures

Case I, II, and III departure procedures provide lateral and longitudinal separation of aircraft by designating flight path, restricting speed and altitude, and specifying launch interval. During Case III departures, V/STOL aircraft are subject to a 300-knot and 1-minute launch interval restriction.

V/STOL departure procedures

The following table lists the V/STOL departure procedures used in each case of departure:

Weather Criteria	Departure Procedure
Case I	After takeoff, aircraft proceed straight ahead on the BRC, climb to 500 feet and 7 miles, and execute an unrestricted climb in VMC beyond 7 miles.
Case II	After takeoff, aircraft proceed straight ahead on the BRC and climb to 500 feet and 7 miles. At 7 miles, aircraft turn to intercept the 10-mile arc and fly this arc until they intercept their assigned departure radial. The 500-feet limit is removed past 7 miles if the aircraft's climb can be continued in VMC. Aircraft maintain climb speed until on top in VMC.

Continued on next page

V/STOL departure procedures (continued)

Table continued from page 11-I-5.

Weather Criteria	Departure Procedure
Case III	After takeoff, aircraft climb on the BRC, accelerate to 300 KIAS, and cross the 5-mile fix at 1,500 feet or above. Aircraft then intercept and fly on the 10-mile arc until they intercept their assigned departure radial. At the 10-mile arc, aircraft commence a 300 KIAS climb to their assigned departure altitude. The Departure radial assignment criteria is the same as for helicopters—a minimum of 20 degrees standard separation between departure radials.

Additional V/STOL Case III departure procedures

Some other V/STOL specific Case III departures procedures include:

- Case III departure procedures apply whenever weather minimums at the ship are below Case II minimums and during night operations with no visible horizon.
- Case III procedures do *not* apply during night CQ or when the tactical situation dictates.
- The commanding officer or OTC can direct aircraft to launch under Case III procedures.
- Aircraft that launch must be on departure control's radio frequency.

Continued on next page

Rendezvous procedures

Different rendezvous are dictated based on the case departure used.

Case Departure	Rendezvous Procedure
Case I	Aircraft rendezvous according to the squadron tactical doctrine.
Case II	Aircraft rendezvous between 20 and 50 nm from the ship on the left side of the departure radial. Squadron tactical doctrine may dictate other types of rendezvous. If aircraft are not in VMC on top, flight leaders must report at their assigned altitudes. When an aircraft reaches its assigned altitude, if it is still in IMC, the aircraft establishes holding on the departure radial between 20 and 30 nm, at best fuel endurance airspeed, and reports that it is established in holding. Departure control issues a clearance to proceed on the aircraft's mission, if operationally required, or instructions to continue holding until the aircraft can be vectored to the marshal stack for recovery.
Case III	Aircraft rendezvous by using Case II procedures.

Departure Voice Reports

Introduction

Amphibious departure voice reports are similar to the reports used for carrier operations.

Voice reports

The following table lists the standard voice reports common for each particular case of departure:

Report	Case II	Case III
AIRBORNE	X	X
PASSING ANGELS TWO POINT FIVE	X	X
ARCING	X	X
Established on departure radial (OUTBOUND)	X	X
IMC (POPEYE) with altitude	X	X
ON TOP with altitude	X	X
Mission readiness (KILO)	X	X

NOTE: When in IMC, POPEYE is a mandatory report for aircraft upon reaching assigned departure altitude or FL 180 for V/STOL aircraft. This report alerts the departure controller that further instructions are required.

Section J
Amphibious Arrival Procedures

Overview

Introduction

The most involved control procedures occur when aircraft are recovered. As an approach, marshal, or final controller, you are a member of the AOCC/HDC team responsible for safe and expeditious recoveries. Standardized marshal and approach procedures for both helicopters and V/STOL aircraft assist you in the performance of amphibious air traffic control duties.

In this section

This section consists of the following topics:

General Marshal Procedures for Amphibious Ops

Introduction

A lot of coordination takes place between different divisions and controllers before aircraft are recovered. Information must be obtained from inbound aircraft and relayed to the appropriate agencies or personnel. Also, aircraft must be sequenced and separated for a smooth and timely recovery. In the AOCC/HDC, you, as the marshal controller, start the information gathering and initial aircraft recovery setup process.

Aircraft recovery information

Flights check in with AOCC/HDC upon entering the control area or when directed to do so by other controlling agencies. The flight leader should provide you, the marshal controller, with the following information:

- Call sign
- Position
- Altitude
- Lowest fuel state (in hours and minutes for helicopters and in pounds for fixed-wing aircraft)
- Souls on board
- Other pertinent information, such as navigational aid status, ordnance status, etc. that may affect aircraft recoveries

NOTE: In VMC, pilots must report *see you* when they have visual contact with the ship.

Marshal recovery information

As the marshal controller in the AOCC/HDC, you should provide an inbound flight with the following recovery information:

- EAT
- Marshal instructions or vectors, as required
- BRC and estimated recovery time
- Altimeter setting
- Time check
- Other pertinent information such as wind and weather
- Clearance into the control area

NOTE: In VMC, AOCC/HDC switches flights to PriFly's frequency at 5 miles

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Marshal assignment considerations

Topographical features, types of ships in formation (CV, etc.), operational restrictions, and aircraft capabilities are factors that must be considered in the assignment of marshal. When issuing instructions, AOCC/HDC should use the following guidelines:

- Holding patterns should be clear of clouds (VMC) if possible.
- Weather conditions should be anticipated to provide marshaling in visual conditions if practical.
- Aircraft should not be required to climb or descend into the overcast (IMC) to comply with altitude limits if control can be safely exercised above or below the overcast.
- Aircraft should be retained in formation when possible.

–Formation flights are authorized a maximum of four aircraft at any one assigned altitude.

–The maximum flight size in IMC is a section of two aircraft.

Vertical separation in marshal

The following vertical separation should be used for aircraft in marshal:

Type Aircraft	Vertical Separation
Helicopters	500 feet
V/STOL	1,000 feet

Helicopter Marshal Procedures

Introduction

Helicopter and V/STOL aircraft marshal procedures are different. This section covers the basic marshal procedures for helicopters.

Case II/III Helicopter marshal

Unless otherwise specified in the operations orders or instructions issued by AOCC/HDC, the helicopter marshal pattern must be a right-hand racetrack pattern holding between the 7- and 9-mile fixes. The base altitudes for helicopter TACAN marshal patterns one, two, and three must not be less than 1,000 feet. The inbound leg must pass over the marshal fix.

LHA/LHD helicopter TACAN marshals are as follows:

- The TACAN marshal one is on the 180° radial relative to the BRC at a distance of 7 miles. The altitude is as assigned.
- The TACAN marshal two is on the 270° radial relative to the BRC at a distance of 7 miles. The altitude is as assigned.

WARNING

TACAN marshal two must not be used during mixed aircraft operations.

- The TACAN marshal three is on the 090° radial relative to the BRC at a distance of 7 miles. The altitude is as assigned.
- The overhead TACAN marshal is an overhead holding pattern, inbound 210° relative to the BRC at an altitude of not less than 1,500 feet.

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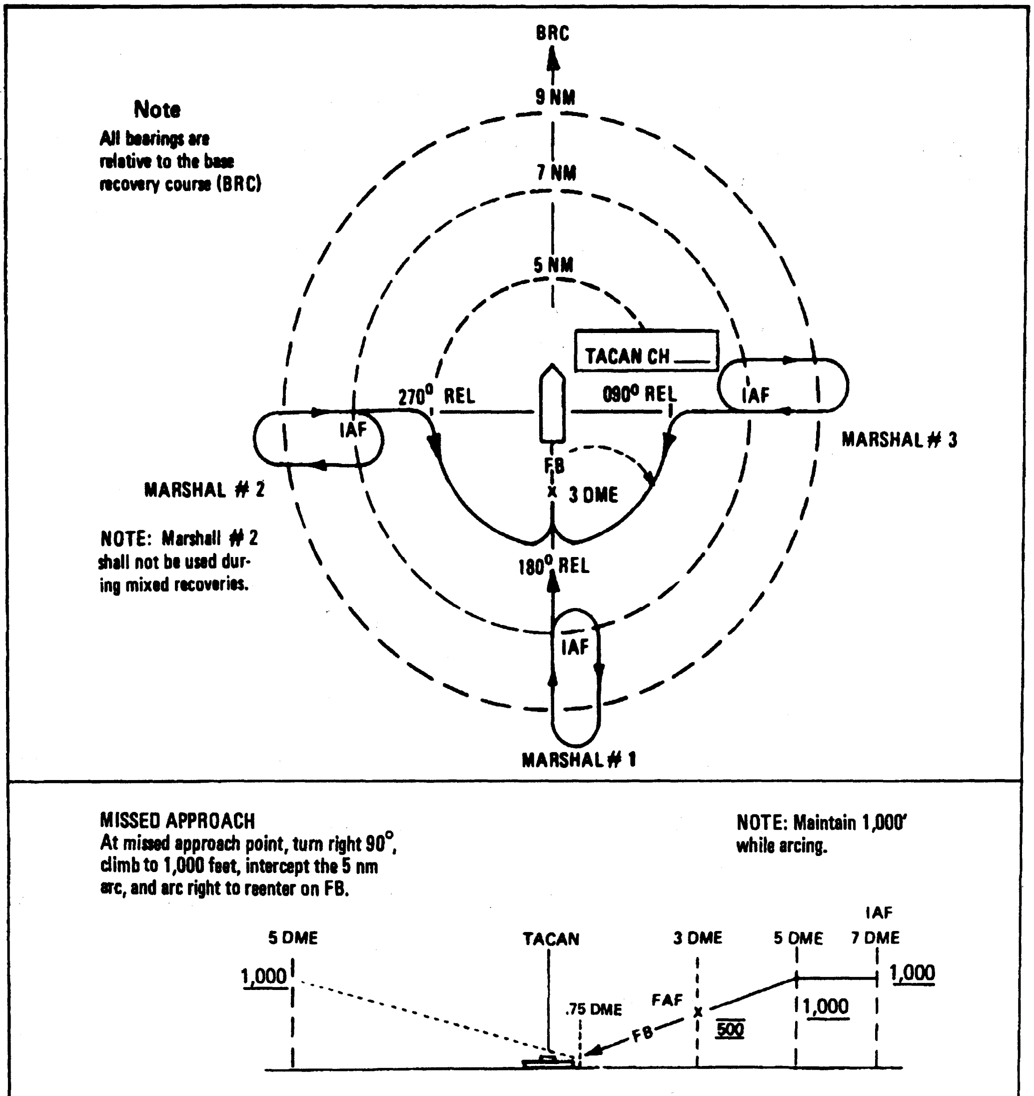
Helicopter TACAN approach

A helicopter TACAN approach is depicted below:



LANDING MINIMA				FLIGHT DECK ELEVATION	HIGHEST OBSTRUCTION
CATEGORY	LHA/LHD	LPH			
S-PAR	270-½	250-½	200(200-½)	LPH-50'	LPH-150'
S-ASR S-TAC	370¾	350-¾	300(400-¾)	LHA/LHD-70'	LHA/LHD-200'

Continued on next page

Helicopter emergency marshal patterns

An emergency pattern provides established procedures for aircraft pilots who experience lost communications when returning to the ship during IMC. Pilots must be briefed on the emergency procedures before launch on the air plan. These procedures presume that an aircraft has operable TACAN azimuth and DME.

LHA/LHD operations are unique in that helicopter final recovery times cannot be predicted because hot refueling can extend mission times. An emergency marshal procedure must be used that will remain in effect and not require an update even when the aircraft's final recovery time is extended by hot refueling. The helicopter emergency marshal procedures provide for the recovery of 24 individual helicopters experiencing lost communications of IMC.

The aircraft, on the ship's air plan, are assigned an emergency marshal point. Radial, DME, EEAT, and altitude assignments are based on the marshal point assigned. The marshal point assigned must not be changed during the aircraft's event except as requested by the pilot or HDC and only with the approval by both parties.

Some special notes concerning helicopter emergency marshal patterns are listed below:

- During mixed aircraft operations, helicopters must cross the EFB at or above 2,000 feet.
- TACAN marshal three conflicts with the emergency marshal pattern.
- Helicopter airspeed throughout the emergency marshal pattern is 90 knots except during holding when fuel must be conserved.

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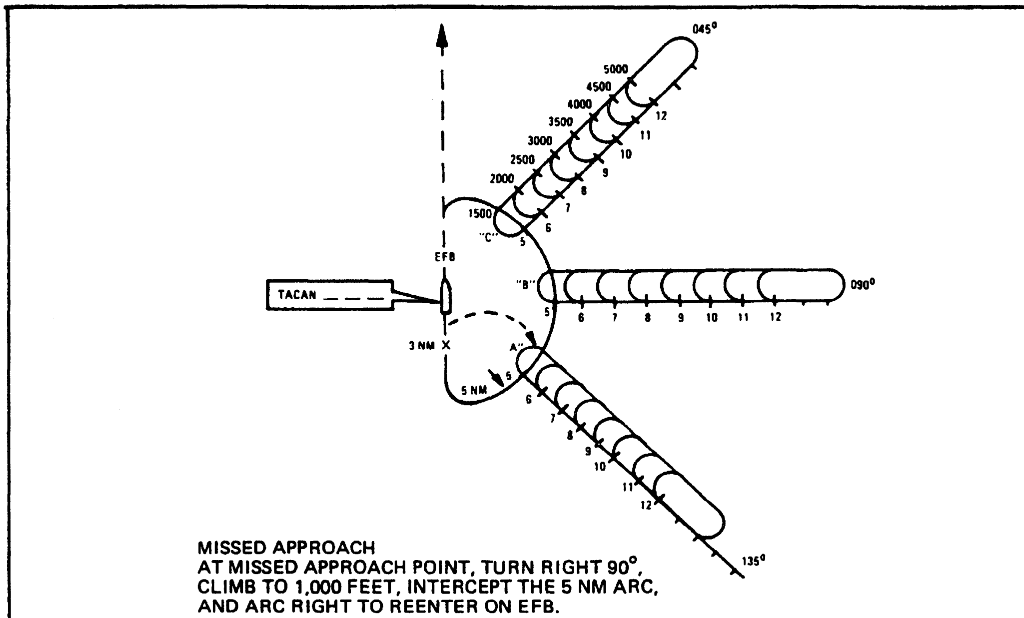
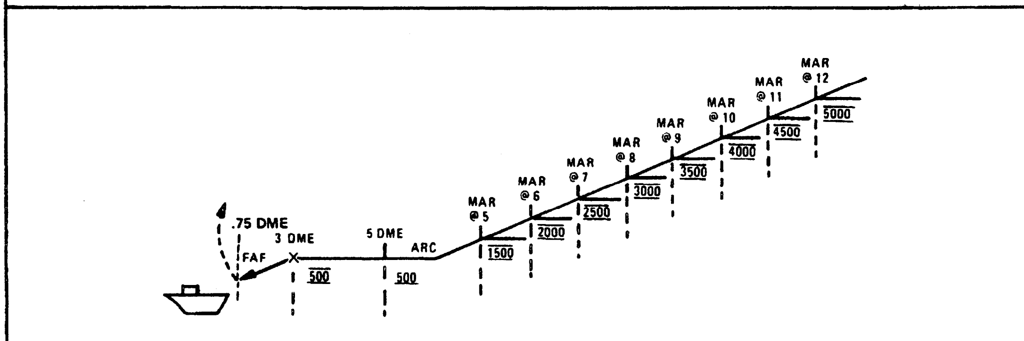
Helicopter emergency marshal patterns (continued)

Amphibious helicopter emergency marshal patterns are depicted below:





LANDING MINIMA				FLIGHT DECK		HIGHEST OBSTRUCTION	
CATEGORY	LHA/LHD	LPH	WX	ELEVATION			
S-TAC	370-3/4	350-3/4	300 (400-3/4)	LHA/LHD-70′	LPH 50′	LHA/LHD-200′	LPH-150′

Continued on next page

Helicopter emergency marshal altitudes and EEATs

Amphibious helicopter emergency marshal altitudes and EEATs are listed in the following table:

Marshal point	Marshal radial (relative degrees)	DME	Altitude	EEAT (16 helos) 1st	EEAT (16 helos) 2nd	EEAT (24 helos)
A5	135	5	1500	00	30	00
A6	135	6	2000	01	31	01
A7	135	7	2500	02	32	02
A8	135	8	3000	03	33	03
A9	135	9	3500	04	34	04
A10	135	10	4000	05	35	05
A11	135	11	4500	06	36	06
A12	135	12	5000	07	37	07
B5	090	5	1500	13	43	13
B6	090	6	2000	14	44	14
B7	090	7	2500	15	45	15
B8	090	8	3000	16	46	16
B9	090	9	3500	17	47	17
B10	090	10	4000	18	48	18
B11	090	11	4500	19	49	19
B12	090	12	5000	20	50	20
C5	045	5	1500	21	51	26

Continued on next page

Helicopter emergency marshal altitudes and EEATs (continued)

Table continued from page 11-J-8.

Marshal point	Marshal radial (relative degrees)	DME	Altitude	EEAT (16 helos) 1st	EEAT (16 helos) 2nd	EEAT (24 helos)
C6	045	6	2000	22	52	27
C7	045	7	2500	23	53	28
C8	045	8	3000	24	54	29
C9	045	9	3500	25	55	30
C10	045	10	4000	26	56	31
C11	045	11	4500	27	57	32
C12	045	12	5000	28	58	33

Helicopter emergency marshal pattern notes

The following notes apply to amphibious helicopter emergency marshal patterns:

- Pilots proceed outbound from the ship and climb or descend to their assigned emergency marshal altitude.

Continued on next page

Helicopter emergency marshal pattern notes (continued)

- Pilots proceed directly to their assigned emergency marshal fix/point.
- Pilots make right turns in holding with 2-mile legs.
- Pilots must report established in the holding pattern with fuel state and souls onboard.
- At their assigned EEAT, pilots depart the marshal fix and proceed inbound descending to 500 feet. Pilots must report departing with current fuel state.
- At 5 DME, pilots arc clockwise to intercept the 180 degree relative radial and proceed inbound.
- At the FAF (3 DME), pilots begin descent and report at the FAF with current fuel state.
- Pilots should watch for a light from the tower and land on the LSE's signal.

Helicopter emergency marshal explanation

Each aircraft is assigned an emergency marshal point prior to launch on the air plan. If a helicopter assigned marshal point C6 experiences lost communications in IMC, the pilot proceeds to the 045 degree relative radial. Once established on this radial, the pilot enters holding at 6 DME and an altitude of 2,000 feet. The pilot commences approach at the preassigned EEAT (either 22 or 52 minutes past the hour).

For example, if the time is 1515Z, the pilot commences approach at 1522Z. If the time is 1535Z, the pilot commences approach at 1552Z.

V/STOL Aircraft Marshal Procedures

Introduction

V/STOL aircraft marshal operations are normally faster paced than helicopter marshal operations. This section covers the basic procedures you need to know for conducting V/STOL marshal operations.

Case II/III V/STOL marshal pattern

The TACAN primary marshal is on the 180 degrees radial at a distance of 1 mile for every 1,000 feet of altitude plus 15 miles (angels plus 15). The base altitude assigned must not be less than 6,000 feet.

The TACAN overhead marshal is an overhead holding pattern in which aircraft proceed inbound on a 210 degree bearing at an altitude as assigned (not less than 6,000 feet). Aircraft fly a 2-minute, racetrack pattern by making left-hand turns with the inbound leg passing over the holding fix.

V/STOL departing marshal procedures

The following procedures apply to V/STOL aircraft that depart from marshal:

- Operational/weather conditions permitting, aircraft are cleared to depart marshal every 2 minutes.
- Descent from marshal must be at 250 knots, 4,000 to 6,000 feet per minute, until platform (5,000 feet). At platform, the rate of descent must be reduced to arrive at the 12-mile gate at 1,200 feet. Aircraft must transition to landing configuration at the gate.
- Aircraft on a TACAN or radar approach must correct from the marshal radial to the final bearing at 20 miles. When the final bearing is within 10 degrees of the reciprocal of the marshal radial, the pilot must make a gradual correction. When the final bearing is greater than 10 degrees, the pilot must turn 30 degrees. If the aircraft is not established on the final bearing at 12 miles, the pilot must fly a 12-mile arc until intercepting the final bearing.

Continued on next page

V/STOL departing marshal procedures (continued)

- Pilots flying an overhead TACAN approach must correct to the final bearing, if it decreases, by flying 90 degrees of penetration turn and arcing to the new bearing. If the final bearing increases, aircraft fly the standard penetration turn and continue to intercept the new final bearing before the 12-mile gate.

"Signal DELTA"

The following *DELTA* procedures apply when a delay is anticipated or needed:

- Aircraft in holding must continue and wait assignment of new EATs. The pilots must acknowledge a signal *DELTA*.
- Aircraft on approach above platform must level off at the next lower odd-numbered altitude and hold on the inbound bearing at a range in miles equal to the holding altitude in thousands of feet plus base distance (angels plus 15). The pattern must be the same as the original marshal pattern. Pilots must acknowledge receipt of *DELTA* and repeat distance and altitude information.
- Aircraft on approach at platform or below platform must continue a normal approach and await specific instructions from the controller before they dump fuel.
- When possible, a new EAT must be assigned with a minimum of 6 minutes before descent is continued. If the pilot loses radio communications before he or she receives a new EAT, the pilot must depart the holding fix at 6 minutes past the time of receiving a *DELTA* and proceed to the TACAN emergency marshal assigned and hold until the preassigned EEAT.

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V/STOL emergency marshal procedures

The emergency marshal for V/STOL aircraft must be on the 150-degree relative radial at 1,000-foot intervals commencing at 5,000 feet. The DME must be angels plus 15 miles.

After pushover, the aircraft tracks inbound on the 150-degree relative radial, levels at 1,200 feet, and turns to intercept the 12-mile arc. The aircraft flies on the 12-mile arc until it intercepts the emergency final bearing and executes the final portion of the TACAN approach. If an aircraft is unable to land, it must fly the missed approach as published on the TACAN procedure. Entry into the holding point must be at the assigned angels.

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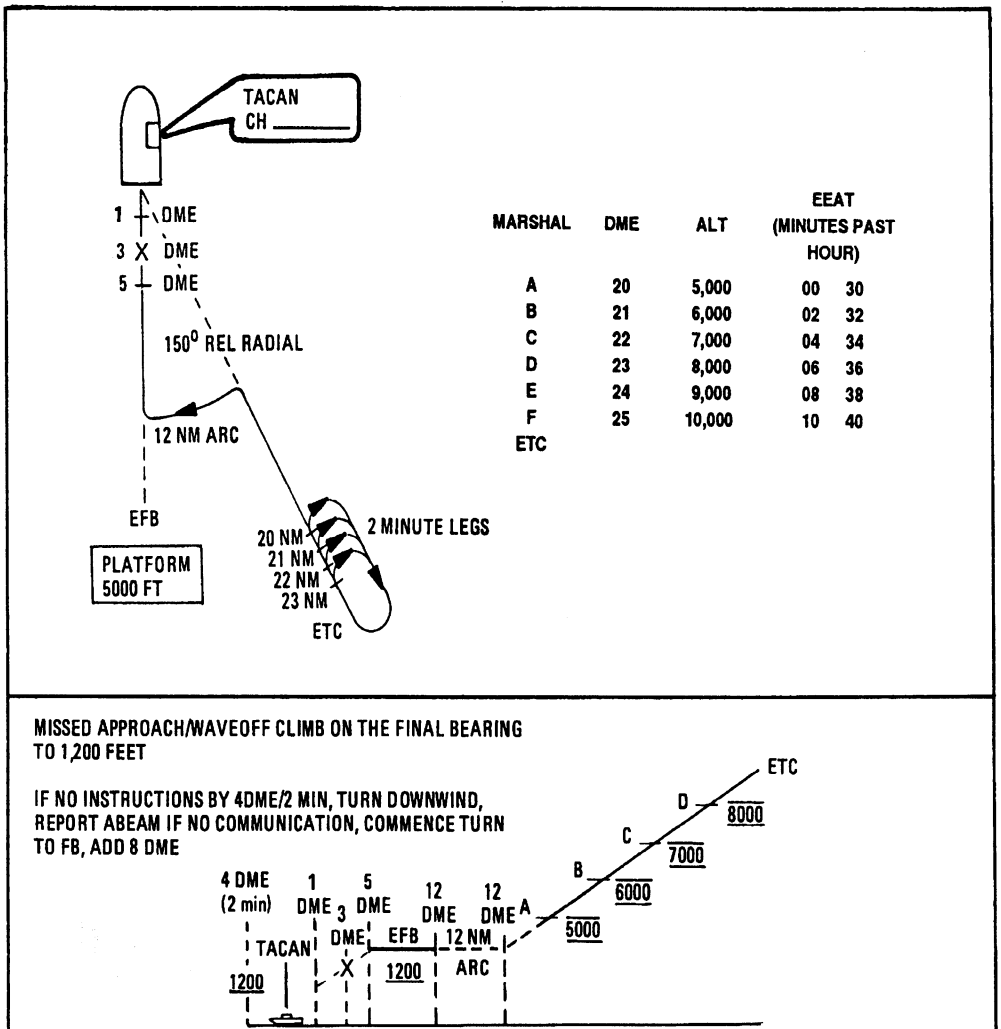
V/STOL emergency marshal pattern

The V/STOL emergency marshal pattern is depicted below:



LANDING MINIMA			
CATEGORY	LHA/LHD	LPH	
S-TAC	470-1	450-1	400 (500-1)

Approach Procedures

Introduction

As an approach or final controller on an amphibious ship, you provide the final control instructions to aircraft for recovery on the ship or handoff to PriFly. The pilot depends on you to provide accurate course information. This information becomes critical in IMC.

Case I helicopter visual descent and approach

Case I is used only when it can be anticipated that flights will not encounter IMC at anytime during the descent, break, and final approach.

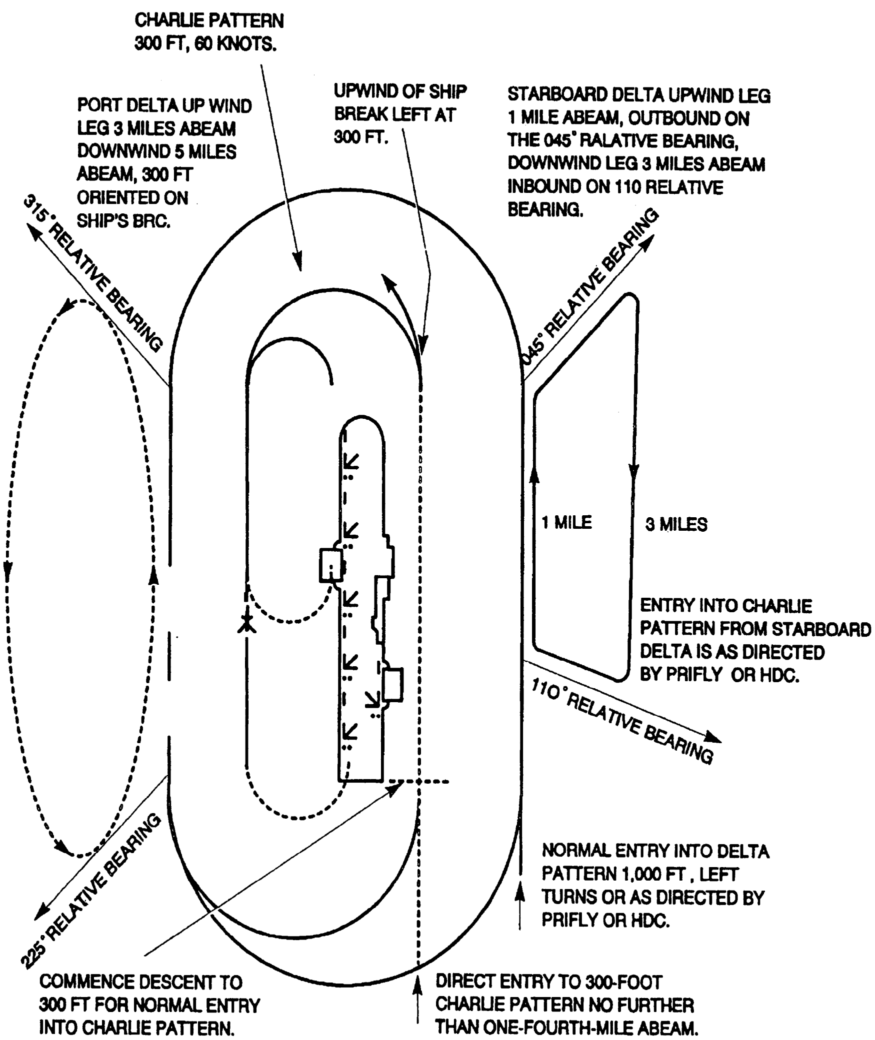
During mixed aircraft operations the following procedures apply to helicopter recovery operations:

- Helicopters must enter the starboard delta pattern located 1 mile to the starboard side of the ship at 300 feet and oriented on the BRC.
- The helicopter break altitude must not exceed 300 feet.
- Pilots must report *see you* when they have visual contact with the ship in VMC. If the flight is in VMC, AOCC/HDC switches the flight to PriFly's frequency at 5 nautical miles.

Continued on next page

Charlie and starboard delta patterns

Normally, when the ship's deck is ready for recovery, helicopters enter the charlie pattern. If the ship's deck is not ready for recovery or a delay is necessary, helicopters enter the starboard delta pattern. Both the charlie and the starboard delta patterns are depicted below:



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Case II helicopter controlled descent/visual approach

During Case II helicopter approaches, AOCC/HDC are required to use close (positive) control until the flight leader/pilot reports the ship in sight. AOCC/HDC must be fully manned and ready to assume a Case III recovery should the weather deteriorate below Case II minima.

Note: Case II approaches must not be flown when Case III departures are in progress. Case III approaches must be used during marginal VMC.

Case III helicopter approach

Case III recoveries apply to single aircraft only. The exception to the single-aircraft requirement is when an aircraft that is experiencing difficulties is recovered on the wing of another aircraft. Formation flights by dissimilar aircraft must not be attempted except in extreme circumstances when no safer methods are available. Whenever possible, precision approach radar must be used.

Case I V/STOL visual descent and approach

The same criteria and check-in procedures apply to V/STOL aircraft as outlined for helicopters except for the following:

- The pilot should plan his or her descent so that the aircraft arrives at the initial point, 3 miles astern, 800 feet, wings level, and parallel to the BRC.
- The flight leader must report to PriFly when descending from the delta pattern and arriving at the initial point (IP).
- Each flight must execute a normal break not more than 5 miles ahead of the ship.

Continued on next page

Case II V/STOL controlled descent/ visual approach

During Case II V/STOL approaches, close (positive) control by AOCC/HDC is mandatory until the pilot reports *see you* at which time normal Case I procedures apply.

If the first flight is unable to gain and maintain visual contact with the ship at the 12-mile gate, a controlled descent to break altitude (800 feet) must be initiated at the gate. If less than Case II weather exists at 5 miles, AOCC/HDC is required to vector the first flight into the waveoff pattern and to a Case III marshal pattern. Case III approach procedures are then mandatory for recovery of aircraft that arrive thereafter.

Case III V/STOL approach

During Case III, V/STOL aircraft are required to descend to arrive at the 12-mile gate at an altitude of 1,200 feet. Unless otherwise directed, aircraft must transition to landing configuration at the 12-mile gate.

NOTE: Unless an aircraft is in level flight, radio frequency changes are not authorized below 2,500 feet.

Approach minimums

The following table lists the approach minimums for V/STOL aircraft:

V/STOL Aircraft	
Type of Approach	**Minimums (ceiling and visibility)**
S-PAR day	300 feet and 1 mile
S-PAR night	400 feet and 1 mile
S-ASR	500 feet and 1 1/2 mile
S-TAC	500 feet and 1 1/2 mile

Continued on next page

Approach Procedures, Continued

Approach minimums (continued)

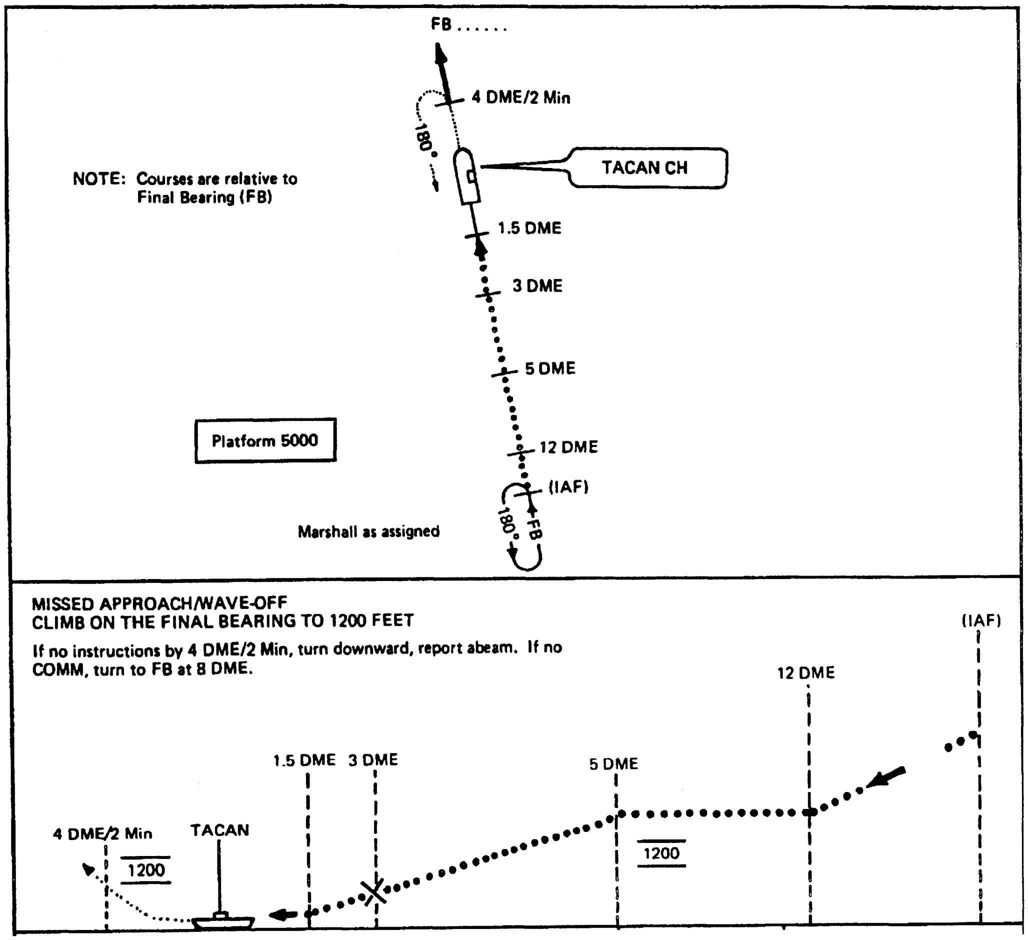
The following table lists the approach minimums for helicopters:

Helicopters	
Type of Approach	**Minimums (ceiling and visibility)**
S-PAR	200 feet and 1/2 mile
S-ASR	400 feet and 3/4 mile
S-TAC	400 feet and 3/4 mile

Continued on next page

V/STOL TACAN approach

A TACAN approach for V/STOL aircraft is depicted below:



LANDING MINIMA				FLIGHT DECK ELEVATION	HIGHEST OBSTRUCTION
CATEGORY		LHA/LHD			
S-PAR	DAY	370-1	300 (300-1)		
	NIGHT	470-1	400 (400-1)	LHA/LHD-70'	LHA/LHD-200'
S-ASR		470-1½	400 (500-1½)		
S-TAC					

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Additional information

For a complete description of amphibious air traffic control procedures, refer to *LHA/LPH/LHD NATOPS Manual,* NAVAIR 00-80T-106, and *Amphibious Ships Air Traffic Control Manual,* AE-LHATC-OPM-000.

CHAPTER 12

FACILITY OPERATIONS

Overview

Introduction

This chapter covers issues you will encounter in the management of an ATCF, Certain ATC management procedures are addressed, and some additional areas are highlighted that will be essential to you when you become a manager at an ATCF. Required reports and general administrative duties are also covered.

Not every responsibility of the rating can be covered in this chapter. It is your responsibility to be familiar with the publications, directives, instructions, and "rules of the road." This chapter should point you in the right direction and provide you with the basic knowledge required to perform as a manager at an ATCF.

Objectives

The material in this chapter will enable you to:

- List the duties and responsibilities of ATC management billets.
- Describe some of the personnel management requirements specific to the AC rating.
- Identify the procedures for collecting data and investigating an accident or incident.
- Identify an operational error and an operational deviation.
- Recognize those portions of *FAR,* Part 65, that apply to the issuance of ATC tower operator certificates and ratings and the regulations governing the use of those certificates and ratings.
- Discuss the requirements involved for issuing an ATCS certification.
- Define the procedures for the suspension and/or revocation of an ATCS certificate.
- Describe the training specific to the AC rating.
- Identify the special programs unique to the ATC rating and discuss the requirements and importance of each.
- Explain the various facility reports and logs maintained at an ATCF.

Continued on next page

Objectives (continued)

- Discuss the purpose and function of the ATC contingency plan.
- Define the different types of flight inspections and their purposes.

Acronyms

The following table contains a list of acronyms that you must know to understand the material in this chapter:

Acronym	Meaning
AATCFO	Assistant ATCF officer
AC	Air traffic controller
Air Ops	Air operations
ARTCC	Air route traffic control center
ASR	Airport surveillance radar
ATC	Air traffic control
ATCF	Air traffic control facility
ATCFO	ATCF officer
ATCRBS	Air traffic control radar beacon system
ATCS	Air traffic control specialist
CAAC	Counseling and assistance center
CEB	Controller evaluation board
CP	Command post
CTO	Control tower operator
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FOIA	Freedom of Information Act

Continued on next page

Acronyms (continued)

Table continued from page 12-2.

Acronym	Meaning
FWS	Facility watch supervisor
GEMO	Ground electronics maintenance officer
HAT	Height above touchdown
hr	Hour
IFR	Instrument flight rules
LDO	Limited duty officer
LCPO	Leading Chief Petty Officer
NAS	Naval air station
NAVREP	Navy representative to the FAA
NMCC	National military command center
OJT	On-the-job training
PAR	Precision approach radar
PEB	Procedures evaluation board
PTH	Productive training hour
SESEF	Shipboard electronic systems evaluation facility
TERPS	Terminal instrument procedures
VFR	Visual flight rules

Continued on next page

Overview, Continued

Topics

This chapter is divided into the following seven sections:

Section A
Facility Organization and Management

Overview

Introduction

Management positions play a vital role in the effective operation of an ATCF. Certain management issues require the involvement of both management and supervisory-level controllers in determining facility policies.

In this section

This section covers the following two topics:

Management Positions

Introduction

The ATCF's management team provides the critical guidance, decision making, and supervision required for the daily operations of an ATC division. Normally, this team consists of an AC LDO and one or more AC Chiefs, Senior Chiefs, or Master Chiefs. The size and operational requirements of the facility determine the number and types billets established for each ATC division.

ATCF officer (ATCFO)

The ATCFO is ultimately responsible for the overall management of the air traffic control facility. Normally, the ATCFO is an air traffic control Limited Duty Officer (LDO). The duties and responsibilities of the ATCFO include, but are not limited to, the following:

- Ensuring proper coordination and control of air traffic within the ATCF area of jurisdiction
- Establishing standard operating procedures
- Initiating collection of data relating to accidents and incidents and safeguarding the data
- Ensuring training, supervision, and assignment of ATC personnel
- Conducting liaison with NAVREPs, FAA representatives, and representatives of other agencies
- Determining qualification of ATC personnel
- Coordinating with the Ground Electronics Maintenance Officer (GEMO) on requests for equipment replacement or enhancement

Assistant ATCF officer (AATCFO)

The AATCFO assists the ATCFO in the management and administration of the facility. The duties and responsibilities of the AATCFO include the following:

- Providing interface with the FAA and other military facilities
- Developing, reviewing, and standardizing ATC procedures

Continued on next page

Leading chief petty officer (LCPO)

The LCPO works closely with the ATCFO in the administration, supervision, and training of assigned personnel. This includes coordinating the assignment and supervision of enlisted personnel within the air traffic control facility. The LCPO also assists the ATCFO by making recommendations concerning improvement of spaces, procedures, working conditions, and the welfare and morale of enlisted personnel.

Branch chief

Each branch in the facility must have a branch chief assigned. We will give only a general summary of the responsibilities of these positions. The branch chief has overall responsibility for that particular branch. The branch chief also ensures that proper training is conducted and closely monitors each controller's progress.

Training chief

The training chief must meet certain qualifications to hold this position. These qualifications include the following:

- Having all ATCS ratings for the facility assigned
- Being qualified as an FWS
- Having a minimum of 5 years' experience in ATC

As a training chief, your function will be to plan, execute, and supervise the ATC facility training, certification, and standardization programs. Refer to *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114, for a complete description of the duties and responsibilities of the training chief.

Facility watch supervisor (FWS)

During the hours of operation, each facility must have an FWS designated by the commanding officer on duty at the ATCF. The FWS must be qualified on all operating positions within the facility. The FWS is responsible to the commanding officer or his or her designated representative for the operational performance of the watch crew on duty. At the discretion of the ATCFO, the duties of the FWS can be combined with those of a branch supervisor but should not normally be assigned to a control position. Duties, responsibilities, and authority of the FWS include the following:

Continued on next page

Facility watch supervisor (FWS) (continued)

- FWS equipment responsibilities include, but are not limited to the following:

  –Assuring an equipment checkout is performed at the beginning of each shift
  –Reporting any equipment malfunction to the electronics maintenance division
  –Reporting any derogation or essential services to appropriate agencies such as ARTCCs

- FWS watch duties include, but are not limited to the following:

  –Assuring proper crew briefing and an orderly watch turnover
  –Preparing operating position assignments
  –Assuring controller currency
  –Accomplishing and documenting training
  –Assuring use of proper control procedures and techniques
  –Assuring effective coordination within the facility and interacting facilities
  –Assuring corrective action taken whenever control deficiencies are found

- FWS administrative duties include, but are not limited to the following:

  –Receiving complaints from pilots and adjacent facilities regarding ATC services or procedures provided by the ATCF and accumulating initial data for forwarding to the ATCFO
  –Accumulating and performing the initial documentation of accident and incident records and forwarding these records to the ATCFO immediately
  –Checking and signing daily facility logs and forwarding them to the LCPO or branch chief as dictated
  –Ensuring physical security of all assigned spaces

General Management Issues

Introduction

ATCF management personnel encounter a variety of controller and facility issues that require input from facility controllers and strict adherence to established regulations.

Facility boards, hours of duty, and operating position guidelines are examples of some of the key management issues.

Controller evaluation board (CEB)

Sometimes, a controller's training progress is unsatisfactory or requires modification. The purpose of the CEB is to make recommendations to the ATCFO and evaluate the following:

- The training status and progress of controllers—identifying those who are not progressing satisfactory or who have not been able to meet training schedules
- Those controllers whose performance or training record indicate unsatisfactory performance or inability to master the complexities of the AC rating
- Other matters deemed appropriate by either the ATCFO or LCPO

The ATCFO determines the composition of the CEB.

Procedures evaluation board (PEB)

Have you ever felt that you knew a better way to perform a certain ATC procedure? Well, the PEB is a means for a controller to take an active role in developing ATC procedures for their facility. As a member of the PEB, you and the other board members are tasked with evaluating existing and new ATC procedures for accuracy and improvement. The PEB then forwards any actions or modifications they recommend to the ATCFO for approval.

Hours of duty

ATCF operational requirements dictate the hours that a facility (control tower, radar room, flight planning, etc.) will be manned. In an emergency or operational necessity situation, these normal working periods may be extended in accordance with *FAR*, Part 65. Specifically the regulation concerning working hours can be stated as follows:

Continued on next page

Hours of duty (continued)

Except in an emergency, a certified air traffic control tower operator must be relieved of all duties for at least 24 consecutive hours at least once during each 7 consecutive days. Such an operator may not serve or be required to serve

- for more than 10 consecutive hours or
- for more than 10 hours during a period of 24 consecutive hours unless the controller has had a rest period of at least 8 hours at or before the end of the 10 hours of duty.

As a facility manager, it is your responsibility to monitor the working hours of the controllers assigned to your facility.

Operating positions

The number and types of positions established for a facility are directly related to the ATC function performed by that facility. Also, the volume of traffic influences the overall number of operating positions. During periods of light traffic certain positions may be combined provided the controller is facility-rated or qualified on each of the combined positions. ATCFOs must ensure that the operating positions that are authorized to be combined are specified in local ATC facility directives. It is your responsibility as a manager to periodically review these directives and make recommendations to the facility officer.

Trainees assigned to operating positions

When trainees are assigned to operating positions, they must be under the direct supervision of a controller qualified on the position concerned. The qualified controller retains ultimate responsibility for the position and must use the same radio console unless override capability exists from an adjacent console.

Final control trainees

Trainees must not be assigned as a final controller (precision or surveillance) when the ceiling is below 1,000 feet or the visibility is less than 3 miles. With written approval of the radar chief, trainees that are nearing qualification or who have been qualified as a final controller at another ATCF may be authorized to control aircraft conducting radar approaches under weather conditions established by the ATCFO.

Section B
Aircraft Accidents and Incidents

Overview

Introduction

You must know the correct data collection procedures for ATC accidents or incidents and be able to distinguish the difference between an ATC operational error and operational deviation.

In this section

This section covers the following two topics:

Accident and Incident Data Collection Procedures

Introduction

The importance of collecting accurate data following an accident or incident cannot be overemphasized. An incident can be anything from pilot deviation that results in a flight violation to a near midair collision. An accident is self-explanatory; it can be as minor as one aircraft taxiing into another or as major as an accident that results in aircraft loss or death.

Naval Aviation Safety Program, OPNAVINST 3750.6, contains guidance concerning investigations. Involvement of a civilian aircraft or civilian property should be reported via OPREP 3 NAVY BLUE in accordance with *Special Incident Reporting (OPREP-3, Navy Blue and Unit SITREP),* OPNAVINST 3100.6.

General

Following an accident/incident, ATCF supervisory personnel are required to:

- notify appropriate personnel as outlined in local directives,
- request and obtain a weather observation, and
- ensure pertinent tapes are removed and safeguarded.

As the branch chief, you are required to investigate each accident/incident. You must determine who was involved and the circumstances that might have caused the accident/incident. Naturally, there are almost always two sides to every story. Playbacks of audio and video recordings can help you decide which story is most accurate.

Transcription

All formal accident packages are required to contain the following information:

- A typewritten transcript.
- All recorded communications that concern the subject aircraft for a period of 5 minutes before initial contact until 5 minutes after the accident.
- A chronological summary of the aircraft's flight.

Continued on next page

Transcription (continued)

NOTE: It is a requirement that transcriptions must be made from the copy of the voice recording rather than from the original recording to protect the original from wear or damage.

Tapes

Requests for viewing or duplicating original recordings that may be evidence in a non-U.S. Government investigation must be referred to CNO (N885F). In addition tapes or information that pertain to an accident must not be released to any party without the consent of the appropriate commanding officer. A chain of custody (with signatures obtained including release and assumption of responsibility) is mandatory and must be established for all original voice or video recordings before release of recordings to authorized agencies or officials. The Freedom of Information Act as delineated in *Department of the Navy Freedom of Information Act (FOIA) Program,* SECNAVINST 5720.42, should be referred to in all cases. For the proper format in transcribing tapes, refer to *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Retention of voice and video recordings

Original recordings must be retained for at least 15 days except for mishaps involving Navy ATCFs or DON aircraft. These mishap recordings must be retained until one of the following events occurs:

- The claim or complaint is adjudicated.
- The two-year statute of limitations expires.
- Higher authority releases the recordings.

Statements

Statements must be obtained from the controller and supervisory personnel involved. These statements are in support of administrative action and **may not** be made the basis of legal or disciplinary proceedings unless provisions of Article 31 of the *UCMJ* have been observed. You can find the format for these statements in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Equipment condition

The operating characteristics and condition of equipment (such as the FPN-63) must be examined by technically qualified personnel who were **not on duty** at the time of the accident/incident.

Continued on next page

Equipment condition (continued)

This procedure is used to determine whether equipment could have been a contributing factor. Before the examination no alterations or adjustments must be made on the equipment without the consent of the ATCFO.

ATC personnel involvement in an accident or incident

An air traffic controller that appears to have contributed to an accident or to an incident that jeopardized safety of aircraft must be temporarily relieved of operational duty. The controller must also be referred to the flight surgeon for physical/psychological evaluation. As is the case with the statements, this is not to be considered as disciplinary or punitive action. Relief from operational duty is to remain in effect until the ATCFO has determined the probability of controller involvement.

Preliminary investigation

If, after the preliminary investigation the controller is found NOT to be a responsible or a contributing factor, the controller will be returned to operational duty.

If, after the investigation the controller **IS** found to be responsible, the following action must be taken as a minimum prerequisite to reassignment to operational duty:

- A detailed and complete review of the accident/incident should take place with the controller including a discussion of circumstances related to the accident/incident.
- A reevaluation of the controller on the position(s) to determine if additional training is necessary.
- If retraining is required, it should be conducted with particular emphasis on any weakness revealed during the investigation of the accident/incident.

Retraining, including demonstration of a skill level at least equal to that required for the appropriate portion of sector/position "check-out," is to be considered a recertification of control ability.

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Disciplinary action

In some cases of carelessness or negligence, disciplinary action is a possibility. Owing to the seriousness of such action to the controller, use of the terms *carelessness* or *negligence* must be carefully considered. Use these terms only in cases where the controller is careless or negligent beyond a reasonable doubt.

If there is personal injury or property damage, a lawsuit may be filed. Should a lawsuit occur, the files and records relating to the investigation of the instances, and any disciplinary or other actions taken, may be subject to disclosure to the attorneys for the litigants and produced in court.

If disciplinary action appears warranted, action must be initiated in accordance with appropriate military and/or Office of Personnel Management directives.

Operational Errors and Deviations

Introduction

While an aircraft receives ATC services, operational errors or operational deviations sometimes take place. Errors and deviations occur because ATC equipment, ATC procedures, or other air traffic system elements fail. Failures result in a departure from standards contained in operating manuals, handbooks, or supplementary instructions.

Operational errors

An *operational error* is defined as an occurrence attributable to an element of the air traffic system that results in one or both of the following occurrences:

- **Less than** the applicable separation minima between two or more aircraft, or between an aircraft and terrain or obstacles, as required by *Air Traffic Control,* FAA 7110.65, and supplemental instructions. Obstacles include vehicles, equipment, or personnel on runways.
- An aircraft lands or departs on a runway closed to aircraft operations after receiving air traffic authorization.

Operational deviation

An *operational deviation* is a controlled occurrence where applicable minimal separation was maintained, but one or more of the following situations occurs:

- Less than the applicable separation minima existed between an aircraft and protected airspace without approval
- An aircraft penetrated airspace that was delegated to another position of operation or another facility without coordination and approval
- An aircraft penetrated airspace that was delegated to another position or to another facility at an altitude or route contrary to the altitude or route requested and approved in direct coordination or as specified in a LOA, precoordination, or internal procedure
- An aircraft, vehicle, equipment, or personnel encroached upon a landing area that was delegated to another position of operation without prior coordination and approval

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Procedures for reporting operational errors

A person who is aware of an operational error or suspected operational error is required to report the error to supervisory personnel immediately. The supervisor, in turn, must brief the ATCFO. The ATCFO reports the error in accordance with locally developed procedures. In addition to local reports, the ATCFO must send a message report on all operational errors to CNO (N885F), the appropriate NAVREP, the Naval Safety Center Code 114, and type commander within 3 working days. *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114, specifies the format for this message report.

Section C
Certification Program

Overview

Introduction

All air traffic controllers, both military and civilian, must be certified and facility-rated in accordance with *FAR,* Part 65.

NATOPS Air Traffic Control Facilities Manual, NAVAIR 00-80T-114, establishes the Navy's certification process and augments and amplifies the certification procedures prescribed in the *FAR,* Part 65. In addition to an Airman Written Test, this manual also requires Navy air traffic controllers to have an Air Traffic Control Specialist (ATCS) certificate, FAA Form 7220-1.

The overall certification program has three parts: certification, facility rating, and proficiency training. Two factors must be considered in determining the job proficiency of an air traffic controller: (1) a written test to determine that a controller has a thorough knowledge of the basic rules and regulations, and (2) a practical test to determine the controller's ability to apply this knowledge under actual traffic conditions.

In this section

This section covers the following topic:

Navy ATC Certification Process

Introduction

To be an air traffic controller in the Navy, personnel must meet certain medical and specific AC rating requirements.

Medical requirements

In accordance with the physical standards established in the *Manual of the Medical Department,* military air traffic controllers must maintain a current annual physical. Additionally, each controller must have a current *Clearance Notice (Aeromedical),* NAVMED 6400/2, on file when he or she provides or supervises ATC services.

Initial requirements

Naval personnel must have completed the following initial requirements:

- Satisfactorily completed the FAA airman written test for CTOs (AC Form 8060-37/8080-2)
- Be a graduate of a U.S. military air traffic controller formal basic course of instruction that included PAR practical application

Certificates

The following three certificates are issued to Navy air traffic controllers:

- **Airman written test for CTOs (AC Form 8060-37/8080-2)**. This airman certificate signifies that the applicant has satisfactorily passed the FAA written examination for Control Tower Operator. This is the **minimum** requirement for entry into the AC field. This certificate is obtained upon successful completion of AC(A1) school.
- **Control Tower Operator (CTO) Certificate (AC Form 8060-1)**. This airman certificate is also administered by the FAA. It indicates that the holder is qualified to perform the duties of a control tower operator at a particular airport (e.g., NAS Whidbey Island, WA, control tower). This certificate is issued after the individual has passed locally prepared CTO facility rating examinations and a practical applications test.

Continued on next page

Certificates (continued)

- **Air Traffic Control Specialist (ATCS) Certificate (FAA Form 7220-1).** This certificate is issued to Navy personnel by the authority of the Chief of Naval Operations and authorizes the holder to perform the duties as a Navy Air Traffic Controller. Each Navy controller is required to have the ATCS certificate whether they are working in radar or the tower. Navy controllers receive their initial certificate upon successful completion of AC(A1) school.

Facility ratings

A facility rating is an endorsement to the ATCS Certificate (FAA Form 7220-1) that signifies that the applicant has demonstrated the competence, qualifications, and skills required to control air traffic at a specific location, for example, NAS Lemoore, CA. The following table contains a list of the ATCS ratings that are documented on the back of the ATCS certificate:

Type Rating	Meaning
AOCC	Qualified on all positions specified for air traffic controllers assigned to an AOCC/HDC
APC	Qualified as an approach controller at a nonradar (manual) approach control facility
ARTCC	Qualified on all positions in the radar branch of the CERAP including the en route portion
BASEOPS	Qualified on all positions in base operations. This rating is can only be issued at Class 1 ATCFs
CATCC	Qualified on all positions in a CCA
FACSFAC	Qualified on all ATC positions at a FACSFAC
GCA	Qualified on all positions in a GCA unit
RATCF	Qualified on all positions within the radar branch excluding approach control
RFC	Qualified as an ASR, PAR, and where applicable PALS final controller

Continued on next page

Facility ratings (continued)

Table continued from page 12-C-3.

Type Rating	Meaning
TACC	Qualified on all positions specified for air traffic controllers assigned to a tactical air control center
TRACON	Qualified on all positions within the radar branch of an approach control facility

NOTE: Qualification in supervisory positions such as radar supervisor is not required for the issuance of a particular rating. Also, ATCS ratings are not the same as CTO ratings.

Authority to suspend or revoke CTO ratings or certificates

With ATCFO concurrence, the CTO Examiner may suspend a CTO rating.

To revoke the CTO certificate of a controller, the ATCFO forwards his or her recommendation to revoke to CNO (N885F). If in agreement, CNO will endorse and forward the recommendation to the FAA. The FAA has final revocation authority for CTO certificates.

Authority to suspend or revoke ATCS ratings and certificates

The commanding officer may suspend or revoke an ATCS facility rating. However, CNO (N885F) is the final revocation authority for ATCS certificates issued under the authority delineated in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Suspension of ATCS ratings

A rating must be suspended when controller performance of duties adversely affects the facility's efficiency or safety of flight. In addition, ATCF management is required to suspend controllers from ATC duties when notified by CAAC personnel of alcohol dependency or drug abuse by controllers.

The ATCFO must have the following entry made in the suspended controller's certification/qualification record:

"(Type) rating suspended."

Continued on next page

Revocation of ATCS ratings

If the ATCFO decides to revoke a controller's ATCS rating, he or she must notify the controller promptly in writing. The revocation of a rating must be reflected on the ATCS certificate, in the certificate/qualification record, and in the controller's service record.

When an ATCS rating has been suspended but ATCS certificate revocation is not contemplated, the ATCS rating can be reissued. Reissuance occurs once the controller requalifies on all applicable positions in the time allotted in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

When to consider revocation of the ATCS certificate

ATCS certificate revocation should be considered in the following cases:

- Negligence that has caused an accident
- Alcohol or drug abuse in accordance with *Substance Abuse Prevention and Control,* OPNAVINST 5350.4
- Medically diagnosed physical, character, or behavior disorder or condition which renders a controller NPQ or not aeronautically adaptable for ATC duties and for which a waiver of standards has not been granted by CHNAVPERS
- Failure to make satisfactory progress to obtain an ATCF rating within the time frames established in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.
- Professed or diagnosed anxiety (fear of controlling)
- Questionable moral character evidenced by documented recurrent antisocial behavior

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ATCS reinstatement

Personnel who meet the requirements for reinstatement may apply to CNO (N885F) via the chain of command through an aviation type commander. Reinstatement must not be considered in some cases. These cases include:

- Negligence that caused an accident
- Professed or diagnosed anxiety (fear of controlling)
- Failure to make satisfactory progress to obtain rating
- Drug abuse

Reinstatement requirements are listed in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Section D
Training

Overview

Introduction

Throughout your career as an air traffic controller, you have been in constant training. Like everyone else, you more than likely made the statement: "Why are we having training again?" Training cannot be overemphasized, especially in a rating as complex as ours. We experience continual changes and updates to rules, directives, and instructions.

All of us have heard about facilities that are "short" of controllers. To be more realistic, these facilities are probably short of **qualified** controllers. Due to workforce reductions, facilities must do more with less. Therefore, it is crucial that you, as a facility manager, establish an effective training program to produce quality controllers in the shortest time possible.

In this section

This section covers the following two topics:

Controller Training Process

Introduction

For a new controller at an ATCF, the facility's training program is vital to successful qualification on each of the ATC positions. The training program normally centers around the trainee's use of a facility manual, air operations manual, lesson topic guides, local qualification standards, and performing OJT to qualify.

Productive training hours (PTH)

PTH is defined as a 60-minute period during which **meaningful** OJT training is accomplished at an operation position in relation to the trainee's level of experience. Productive training is any period in which the trainee is afforded the opportunity to do one or more of the following:

- Experience a new situation
- Learn a new procedure
- Master a previously taught procedure

NOTE: PTH may be acquired in whole or fractional hours.

Allotted PTH for each position

A new controller is authorized a specific amount of PTH to qualify on each position assigned. Time limitations for a position qualification must be based on the maximum PTHs allotted for that position with the exception of the radar final control position. Position qualification for the radar final control position is based on the number of approaches.

Continued on next page

Control tower allotted PTHs

The following table lists the maximum PTHs for control tower positions:

Position	Initial	Subsequent
Flight data	80 hr	40 hr
Ground control	80 hr	40 hr
Clearance delivery	80 hr	30 hr
Local control	160 hr	90 hr
Approach control	160 hr	70 hr

Radar allotted PTHs

The following table lists the PTHs for radar positions:

Position	Initial	Subsequent
Approach control	120 hr	90 hr
Departure control	120 hr	90 hr
Arrival control	120 hr	90 hr
Final control	250 approaches	100 hr
Coordinator	80 hr	40 hr
Flight data	80 hr	40 hr

NOTE: 50 percent of radar final control approaches may be simulated.

Continued on next page

FACSFAC allotted PTHs

The following table lists the PTHs for FACSFAC positions:

Position	Initial	Subsequent
Flight data	40 hr	30 hr
Sector controller	120 hr	60 hr
Assistant sector controller	120 hr	60 hr

NOTE 1: *Initial* qualification applies to controllers without previous position qualification at the position under consideration. *Subsequent* qualification applies to controllers with previous position qualification at any facility at the position under consideration.

NOTE 2: The ATCFO may reduce the allotted PTH based on a facility's number of aircraft operations and air traffic complexity.

Training determination

The decision to terminate training can be made by the ATCFO during any stage of training if a trainee's demonstrated performance indicates an inability to master the complexities of air traffic control. You, as a branch chief and supervisor, are required to track each individual's performance and his or her training hours and ensure that all performance is documented in the individual's training record.

Before a trainee reaches 70 percent of the allotted time on a position, you need to counsel the individual on qualifying. When the trainee reaches 70 percent of the maximum allotted position's OJT time, the following determinations must be made:

- If performance is satisfactory, training will continue.
- If performance is not satisfactory and unusual or extenuating circumstances have occurred, the ATCFO may grant a continuance of training.
- If performance is not satisfactory and there have been no extenuating circumstances, the ATCFO must not grant a continuance. At this point the trainee must be removed from a training status.

Continued on next page

Training determination (continued)

- Revocation action should be initiated before 70 percent of the maximum allotted position time has elapsed if it is determined that a trainee is not progressing satisfactorily or is unable to meet training schedules.

Controller currency

As a supervisor/branch chief, you are responsible for ensuring that your controllers maintain their currency. *Currency* is the minimum prescribed time-on-position which keeps controllers at an acceptable level of performance. ATCFOs shall prescribe monthly time requirements for each operating position.

Radar final control currency

Radar final controllers should not conduct final approaches during IFR conditions unless they have controlled at least 10 approaches in the preceding calendar month. When the amount of air traffic limits proficiency, controllers qualified to control IFR traffic may concurrently count trainee approaches they actively monitor.

Use of target simulators for currency

During insufficient traffic situations and where target simulators are installed, a controller's proficiency can be maintained by using a target simulator under proper supervision. Controller proficiency by simulators must not replace the equitable distribution of actual currency requirements. Only the controller actually making the approach should be permitted to count the approach. Monitored simulated approaches are not considered adequate to maintain currency and proficiency.

Controller Performance Evaluations

Introduction	Before recommending an individual for qualification, you should have evaluated his or her performance. It doesn't matter if it is radar or tower positions, ATC personnel are continually monitored. Monitoring doesn't stop once the person is qualified.
Annual evaluation	Each qualified controller, either fully facility rated or position qualified, is required to have an annual evaluation. If any controller receives an unsatisfactory evaluation, that individual must be made aware of the deficiencies and must be reevaluated within 30 days. If major safety errors are detected, the examiner may recommend temporary suspension of the individual's rating pending further action.
Tape talk program	The purpose of the tape talk program is to periodically review a controller's phraseology, voice quality, and inter/intraphone procedures. This program is used to improve overall professionalism by making the controllers aware that their phraseology is subject to random monitoring and evaluation. At the minimum, a recording should be made for trainees at the 25 % level of PTH and as needed thereafter.
ATC certification and qualification records	The ATC school provides the basic cover and startup pages for the ATC certification and qualification record. Certification and qualification entries are locally prepared.
Transfer and retention of certification and qualification records	When an individual transfers, the training jacket must be forwarded by the commanding officer or his or her designated representative to the individual's next command. Training records are required to be retained at the facility level for a period of 6 months after a controller transfers subsequent to ATCS revocation, separates, transfers to the Fleet Reserve, or retires. Copies may be provided to the individual upon request.

Section E
Facility Administration

Overview

Introduction

As an ATCF manager and supervisor, you are responsible for maintaining and supervising the use of logs, files, and records. You are also tasked with preparing facility reports and providing input to update facility manuals and air operations manual.

In this section

This section covers the following topic:

Facility Logs, Manuals, and Reports

Introduction

An ATCF has many different logs, manuals, and reports with a specific purpose and connection to facility operations.

Daily operations log

Each branch of an ATCF must maintain a daily operations log (FAA Form 7230-4). This log should be maintained by the supervisor on duty and must contain the following:

- Date
- Time of all entries
- Signature of the supervisor on duty
- Description of operational status of primary ATC equipment, for example, radar, NAVAIDS, and so forth.
- Changes to primary ATC equipment operational status throughout the day
- Emergencies
- A record of emergency generator operational checks
- Other items deemed appropriate by the ATC facility officer

NOTE: To eliminate duplication, the ATCFO may assign ATC equipment to specific branches for log entry purposes.

Position logs

A position log (FAA Form 7230-10) must be maintained for each operating position in the facility. The purpose of this log is to ensure that a formal turnover of relief occurs and to establish a reliable record of position manning. These logs must contain the following information:

- Date
- Time
- Position
- Controller-operating initials. (If the position is operated by a trainee, the trainee's initials must be entered after those of the qualified controller responsible for that position).

When a radar approach record is maintained by position, position logs are not required for final controllers.

Continued on next page

Equipment status checklist

Each watch team should complete an equipment status checklist before assuming the watch. The branch chief should review this checklist. The branch chief should bring discrepancies that will effect operations to the attention of the facility officer.

Facility manual

Each facility is required to have an ATC facility manual. This manual addresses facility administration, organization, qualification requirements, training, and air traffic control matters concerning local procedures. It is your responsibility as a supervisor to continually review and recommend changes to this manual. The basic outline for a facility manual is provided in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Air operations manual

Local flying rules and instructions are found in regulations issued by the various fleets, forces, naval air stations, and other naval activities where aircraft are based or operated.

The locally prepared air operations (Air Ops) manual covers pertinent information that applies primarily to the airfield and associated terminal airspace, for example, course rules.

Since the Air Ops manual establishes local regulations, it is considered a continuation or supplement to *NATOPS General Flight and Operating Instructions Manual,* OPNAVINST 3710.7. OPNAVINST 3710.7 contains the overall standardized general flight and operating instructions for the Navy and Marine Corps facilities.

As a senior AC, you should become familiar with both the Air Ops manual and the facility manual. You should make your ideas for improved or more efficient procedures known to the command. The best evaluation of an Air Ops manual comes from the pilots who use it and the controllers who provide the services regulated by it.

Air traffic activity report

The items listed on the air traffic activity report apply to all USN and USMC ATCFs. A traffic count is not required for forces afloat. The parent command is required to report the traffic count for satellite fields

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Air traffic activity report (continued)

The air traffic activity report has the following three parts:

- The control tower operations count
- The approach control operations count
- The special use airspace operations count

Reports of air activity are required by CNO to assist in administration and manning and to support the operational costs of the ATC program ashore.

The air traffic activity report accounts for a facility's ATC operations for an entire calendar year and is closed-out on 31 December. This report is required to be submitted annually on 1 January to reach CNO (N885F) within 30 days of the due date. The facility must send copies to appropriate type commanders, ATC representatives, NISE East (Code 313), and NAVREPs.

To properly fill out the report, you need to know how to count each aircraft operation. The traffic count procedures are outlined in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114. Included in the report are aircraft operations, radar approaches, PALS approaches (where applicable), and items that, in the judgment of the originator, would be of interest to the report addressees. You must also report air traffic control training device usage.

Biennial terminal instrument approach procedures report

Commanding officers of Navy aviation shore facilities are required to review terminal instrument approach and departure procedure requirements for their facility biennially. They do the review in conformance with *United States Standard for Terminal Instrument Procedures (TERPS),* OPNAVINST 3722.16, and *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Reports of this review are submitted to Naval Flight Inspection Group (NAVFIG) in accordance with the following instructions:

- If no changes have occurred, submit a statement that the currently approved procedures are necessary, operationally suitable, and conform with the provisions of TERPS

Continued on next page

Biennial terminal instrument approach procedures report (continued)

- For new or revised procedures, submit a completed NAVAIR Form 3722/1 or OPNAV Form 3722/12
- TERPS data base/obstacle data summaries, OPNAV Forms 3722/10 and 3722/11, must be examined for changes as part of the review process
- Aeronautical information concerning procedures published in DoD FLIP (enroute and terminal) must be examined for accuracy as an integral part of the review process. Corrections to information or a certification as to the accuracy thereof must be included in the report.

Statistical and historical data

There are several reasons for keeping historical data. There is always a need for data concerning airfield operations that support requests for improvement to equipment, manning, and procedures. Also, turnover of military personnel generally precludes being able to use personnel to recall pertinent information that concerns not only the tempo of operations but also previously adopted procedures or the installation of equipment. Therefore, ATCFOs must ensure the maintenance of a continuing historical file that contains data pertinent to the operation of their facility. This file should include the items listed in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114, as well as other relevant data.

Retention and disposal standards

Retention standards for records and data that relate to the daily management of air traffic are established as follows:

- Daily Record of Facility Operation and Position Logs—6 months
- Flight Plans—3 months
- Flight progress strips—3 months

Records and data that relate to mishaps involving Navy ATCFs or DON aircraft must be retained until one of the following events has occurred:

- The claim/complaint has been adjudicated.
- The 2-year statute of limitations has expired.
- The records and data are released as directed by higher authority.

Section F
ATC Contingency Plan

Overview

Introduction

The military has developed a contingency plan in coordination with the FAA to provide continuity of flight operations within the National Airspace System in the event of a significant disruption of ATC service.

The FAA controllers' strike in the early 1980's is a prime example when a contingency plan was needed and used. When this occurred, the system backed up and there was very little movement of air traffic. The military stepped in and gave the FAA a hand at various civilian airports. By their doing this, the air traffic was able to continue.

In this section

This section covers the following topic:

ATC Contingency Plan Process

Introduction

As a manager and supervisor at an ATCF, you must know the procedures that are taken when a significant disruption occurs in the FAA's ability to provide ATC services. Some of your controllers may have to be assigned to assist at FAA airports and centers, and you must have a plan of action to ensure your own facility can provide the needed ATC services in support of your airfield's military mission.

Disruption to the FAA ATC system

Examples of significant disruptions of the FAA system include loss of ATC services caused by events like the following:

- Power failures
- Earthquakes
- Floods
- Hurricanes
- Fires
- Civil disturbances
- Personnel absenteeism

Personnel absenteeism may be due to epidemics, walkouts, "sick-outs," illegal strikes, and the like.

Definition of significant disruption

A significant disruption is a peacetime situation, short of a national emergency, in which the operational capability of one or more FAA ARTCC areas required to provide services is seriously reduced. The intent of the contingency plan is to decentralize authority by delegating contingency actions to the lowest echelons capable of carrying out the required action and making appropriate decisions.

Continued on next page

Assumptions

The ATC contingency plan is based on the following assumptions:

- The FAA will maintain primary cognizance for the overall management of the ATC system.
- At least 30 percent of the ATC system will remain functional.
- Military ATC facilities and services will be fully available.
- A national emergency will be declared if the FAA ATC system becomes nonoperational (greater than 70 percent loss of capability).
- *FARs* will not be waived in any situation other than a national emergency.

How the contingency plan works

The FAA Associate Administrator for Air Traffic will determine that a significant disruption has occurred and will so notify the National Military Command Center (NMCC). The NMCC will, in turn, notify the headquarters of the individual military services. The FAA Headquarters Command Post (CP), in Washington, D.C., will be activated to provide centralized direction of the ATC systems. Upon notification of a significant disruption, CNO will cooperate with the FAA by reducing IFR operations in areas affected by the disruption while maintaining overall continuity of naval operations to the maximum extent possible.

Contingency plan basic elements

The basic elements of the contingency plan include:

- Upon notification that the FAA CP has been activated, CNO (N885F) will ensure that one Navy or Marine Corps officer is on duty at the FAA CP at all times for the duration of the disruption.
- CNO (N885F) will notify all Navy aviation commands of the nature and extent of the disruption and direct compliance with the contingency plan.
- Naval aviation shore facilities will activate local contingency plans to minimize effects of ATC disruptions on Navy air operations.
- Operational commanders will:
  –Reduce IFR operations in affected areas to those operations delineated in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.
  –Institute flow control procedures to smooth IFR traffic in affected areas.
  –If possible, conduct flights by following VFRs in affected areas.
  –If possible, reroute IFR flights to avoid affected areas.

Continued on next page

Contingency plan basic elements (continued)

- Aircraft commanders must list the words *military priority* in the remarks section of the flight plans for all IFR flights required to fly in the affected areas.

Personnel issues

Under the ATC contingency plan, the commanding officer may take the following actions:

- Cancel leave and liberty for military ATC personnel
- Recall military personnel from annual leave
- Extend the length of the workday and workweek

The FAA may redeploy their personnel. However, FAA personnel may not be redeployed from military facilities without the concurrence of the military commanders.

Additional information

Additional ATC contingency plan information can be found in *NATOPS Air Traffic Control Facilities Manual,* NAVAIR 00-80T-114.

Section G
Flight Inspections

Overview

Introduction

Flight inspections are an important part of your responsibilities. They are the quality assurance program which verifies that the performance of NAVAIDS and associated instrument flight procedures conform to prescribed standards throughout their published service volume. Without proper maintenance and operation, your NAVAIDs are worthless and might as well be turned off. As a manager and supervisor, you must know how a flight inspection is requested and how the different types of checks serve your facility.

In this section

This section covers the following topics:

Flight Inspection Responsibilities

Introduction

Safety of flight and effective control of aircraft requires that the components of air navigation systems be accurate, adequate, and reliable. Various types of NAVAIDs are in use that serve a special purpose in the air navigation system. It's your responsibility to ensure that NAVAIDs at your facility are checked as required.

FAA responsibilities

The FAA is designated the authority for inspecting military NAVAIDs based on jointly agreed standard flight inspection procedures. These procedures are contained in the *United States Standard Flight Inspection Manual,* NAVAIR 16-1-520.

NOTE: In this manual, the word *facility* equates to the word *NAVAID.*

Commanding officers' responsibilities

Although flight inspectors recommend NOTAM actions, commanding officers have final authority and responsibility for NOTAM issuance and facility operation. This responsibility includes military facilities that are not part of the national airspace system.

Commanding officers can elect to designate facilities found to be unsatisfactory for continued use in the national airspace system as "For Military Use Only."

NOTE: NOTAMs are not issued on shipboard facilities.

Requesting flight checks

Procedures for requesting and conducting flight inspections of NAVAIDS are contained in *Request for Flight Inspection Report,* FAA Order 8240.32. CV/CVN TACANs should be certified every 18 months, not to exceed 24 months, or upon any TACAN configuration change. The procedures for requesting a SESEF certification or flight inspection for a shipboard TACAN are contained in *Instructions and Procedures Guide for Requesting Flight Certification for TACAN,* NAVAIR AE-TACAN-GYD-000.

Flight Inspection Types

Introduction

As an ATCF manager and supervisor, you need to know when flight inspections are required and scheduled. Also, you must be able to distinguish between the different types of flight inspections.

Site evaluation flight inspection

A *site evaluation* is a flight inspection to determine the suitability of a proposed site for the permanent installation of a facility. It may include checks normally made during a commissioning inspection and any additional tests that may be required.

Commissioning flight inspection

A *commissioning inspection* is a comprehensive flight inspection designed to obtain complete information as to a system's performance and to establish that the system will support its operational requirements.

Periodic flight inspection

A *periodic inspection* is a regularly scheduled flight inspection to determine that a system meets standards and supports its operational requirements. Periodic inspections are considered complete when all scheduled checks are accomplished except as noted for standby equipment. The basic schedule (interval in days) for periodic flight inspections can be found in *United States Standard Flight Inspection Manual,* NAVAIR 16-1-520.

Special flight inspection

A *special inspection* is a flight inspection performed outside the normal periodic interval to define performance characteristics of systems, subsystems, or individual facilities.

An "after accident" special flight inspection can be performed at the request of an accident coordinator or investigator to verify that a system's performance is satisfactory and continues to support instrument flight procedures. This inspection has the highest priority of all flight inspection activities.

Shipboard TACAN inspections are considered completed at the termination of the inspection and are reported as a special inspection

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Surveillance

A *surveillance inspection* is a flight inspection done on a commissioned system or procedure to determine if the parameters inspected meet standards. An out-of-tolerance condition found on a surveillance inspection shall require a special flight inspection and a flight inspection report.

Controllers Involved in Flight Inspections

Introduction

Air traffic controllers play a vital role in the flight inspection process. As a manager and supervisor, you must ensure the controllers who will take part in a flight inspection at your ATCF are thoroughly familiar with the process.

Prior to the flight inspection

Before the flight inspection of a system, the controllers concerned should be briefed and familiar with the flight inspection objectives. They should participate in the initial meetings before the inspection where scope operation, target interpretation, and other techniques are mutually agreed upon. The inspector shall brief controllers concerning the areas and altitudes to be flown and of possible transmitter changes.

Controller evaluation

During flight inspections, qualified personnel should be assigned to control positions. Qualified controllers reduce the potential for control errors and assist the flight inspection team in evaluating the true performance of a system.

Supervisor's role

As the supervisor, you need to keep up with the schedule for flight inspections and inform the ATCFO when an inspection is required. Since you are supervising the controllers involved in a flight inspection, you should be readily available during the inspection.

Radar Flight Inspections

Introduction

The controller plays an active role in the flight inspection of surveillance (primary) radar and ATCRBS (secondary radar) by evaluating the usability (strength) of aircraft target returns on the radar display.

Target strength

Primary radar return varies in strength due to atmospheric conditions, target range, radar cross section, aircraft reflective surfaces, and other phenomena. As with primary radar, the ATCRBS coverage is a function of many factors such as siting, antenna patterns, and so forth.

Strength classification

Usable radar coverage does not mean a usable target return on every scan at every azimuth and all usable altitudes. Controllers use the following target strength classifications:

Primary Radar	
Classification	**Meaning**
Strength 3	Usable target. Target leaves trail or persists from scan-to-scan without trail.
Strength 2	Usable target. Target shows each scan, remains on the display for at least 1/3 of the scan.
Strength 1	Unusable target. Weak target, barely visible, possible miss.
Strength 0	Unusable target. No visible target.

Secondary Radar	
Classification	**Meaning**
Strength 1	Usable target. Visible target, satisfactory for ATC purposes.
Strength 0	Unusable target. No visible target, unsatisfactory for ATC purposes.

Facility Status

Introduction

When a flight inspection of a system is done, the flight inspection team performs certain actions and assigns a classification to inspected systems.

Post flight inspection actions

Upon completion of a flight inspection, the flight inspection team should perform the following actions:

- Brief facilities maintenance personnel
- Determine facility status
- Prescribe the issuance and/or cancellation of NOTAMs
- Prepare flight inspection reports
- Ensure flight information is published

Facility classification

The facility status classification indicates the general performance of a facility as determined from each flight inspection. The flight inspector will assign one of the following classifications:

- **Unrestricted:** The facility meets established tolerances.
- **Restricted:** The facility does not meet established tolerances. The areas that do not meet tolerances must be clearly defined as unusable in a NOTAM. The ATCFO shall ensure that restricted areas (altitude, radials/bearings, and mileages) are subsequently published in FLIP products.
- **Unusable:** The facility is unsafe or unreliable for navigation. A NOTAM must be issued for the facility defining it as unusable.

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